Telephone Engineer

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An Ideal and Its Realization

In the section of the Bell system annual report discussing service improvements attention is called to a further reduction in elapsed time between the signing of an installation or move order and the completion of the work. The ideal is expressed in the following sentence, "The companies aim ultimately to install or move all telephones by appointment on the dates requested by the subscribers."

Anyone familiar with the multiplicity of details necessary in the handling of an installation or move order in a large telephone system will understand the difficulty of attaining such an ideal. It requires the highest type of co-ordination of the work of the commercial, plant and traffic departments so that each unit may perform its part of the operation without delay and exactly at the time required. If the signing of the order by the subscriber is several days in advance of the date for completion of the work, it should be a fairly easy task to time the performance so that the date of completion can be met.

If, however, as is frequently the case, the subscriber delays notice to the telephone company until almost the actual date required the problem is much more difficult. To attain the ideal in such a case involves the elimination of every possible element of lost motion. It requires the most intimate association of the work of the commercial agent who takes the order, the installer who installs the instrument and the traffic clerk who marks the switchboard for service.

If the time between the signing of the order and the completion of the work is to be reduced, departmental routine must be reduced to a minimum. There must be more direct contact between individuals in different departments than through the usual arrangement of following the line to the head then a transfer to the other department and back down the line until the proper place is reached. . . .

If contacts are to be made between departments at places below the heads, it means that employees must be given and must accept greater responsibility for their own work. If experience is truthful, the majority of them will be found able and willing to take the added responsibility. The ideal can be realized only by passing responsibility down the line and by a loosening of the binding strings of office routine. When these things are done, assuming that proper notice is given and major catastrophe does not intervene, the subscriber may expect to have his telephone moved or installed on the date he wishes it done.

Why Worry About Saturation?

It seems to us that the telephone industry, referring particularly to that part of it that has been in the business for many years, is spending too much time worrying about the so-called point of saturation. Worse than that, some portion of it has assumed that this theoretical limit has been reached and has settled down to approach a comfortable old age undisturbed by the cares and difficulties of expanding the plans to meet the demands for service.

It is a long way back to our beginning days in chemistry but we have a hazy recollection of certain chemicals which were soluble in other chemicals up to a certain "point of saturation." This point of saturation was fixed only when the conditions were unchanged. If the temperature changed, if small quantities of other chemicals were introduced or if any one of a number of other changes was made, the saturation point moved up or down or perhaps, for all practical purposes disappeared entirely.

The telephone business has been criticised by men in other utility and industrial organizations because it lacks an aggressive commercial policy. The automobile industry as an example is too busy making and selling cars to pay much attention to the

saturation point. If the mental energy that is wasted in the telephone business in worrying about saturation could be utilized in figuring out ways to install more telephones and to increase the use of those now in service, we would find the saturation point moving along so rapidly that there would be little danger of the business ever catching up with it.

Do Nothing Till the Plant Falls Down

A representative of a public service commission speaking at a recent state convention, commenting upon what he observed as a condition in many telephone exchanges, said that the policy seemed to do nothing in the way of repairs until the plant fell down. While we can not believe that this is a policy in any exchange nor can we believe that it is general in the telephone business, anyone driving through rural territory and even through towns and cities will see enough poorly maintained plants to indicate the source of the speaker's impression.

Perhaps a more accurate statement of the actual policy is that only enough work is done to keep the plant from falling down. The short-sightedness of such a policy is demonstrated every winter when storms take down the ramshackle pole lines. As the summer approaches its end, the construction season should be well along and the fine months of the fall can well be used in overhauling the weaker lines so that the date of their falling down can be postponed indefinitely.

The Federal Communication Bill

During the summer recess of the present extra session of the national congress, little is heard of the Cousins bill which would create a federal commission having jurisdiction over all communication companies. Further activity, however, may be expected as soon as congress reconvenes in the fall. It is the opinion of competent observers the extra session will be so occupied with the legislative matter already in hand that it will not be able to consider legislation affecting the communication field. The next congress likewise will have little time to give to such matters between the time it convenes and the expiration of the present radio commission control. It probably will make a temporary extension of this control rather than attempt to pass a general act in a limited time available.

This does not mean that the matter of a general communications commission is dead. The interest supporting it are such that the question is likely to be kept alive until some kind of a communications act is passed. Whether such an act will provide for a transfer of the present powers of the Interstate Commerce Commission and the extension of such powers can not be predicted at this early date. In general the present control exercised by the Interstate Commerce Commission over telephone companies has not been burdensome and in some ways, particularly in the matter of standardization of accounting, it has been a positive benefit.

Any extension of such control particularly to the smaller companies doing an almost exclusively intra-state business would likely be disadvantageous and an unsatisfactory substitute alike to the public and the companies for the present control by state commissions.

The future of the telephone industry is likely to be profoundly affected by any change in the method of public control and the possibilities of such change should be carefully studied. The industry should keep itself informed of progress in communications legislation and should formulate policies that can be presented when committee hearings are resumed on the Cousins bill and other bills of its type which may follow.

An Important Telephone Consolidation

The passing of control of the Tri-State Telephone and Telegraph Co. into the hands of the Gary interests was probably the outstanding news feature of the telephone business during the past month. For years, the Tri-State has been the largest single operating unit of the Independent telephone group and it has taken a place commensurate with its size in all matters in which the Independent group has been interested. Its president has long served as a director and officer of the United States Independent Telephone Association and its department heads have performed important work in the various divisional organizations of the national association. In every way, the company has been a worthy representative of a great industry.

The Theodore Gary and Co. interests which assume control of the Tri-State is an organization of more than national scope including both operating and manufacturing companies among its affiliated organizations. It is staffed by a group of able and experienced operating executives who likewise have contributed much to the industry. The affiliation of two outstanding organizations like the Tri-State and the Gary interests will mean much to both organizations and will be an important contribution to the strength of the entire Independent telephone industry.

Television in Color

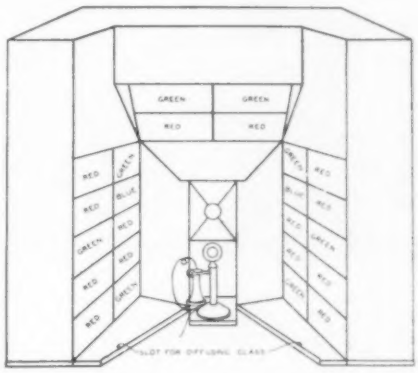
A Very Strong Article on This Important Subject by Mr. H. E. Ives, Member of the Technical Staff, Bell Telephone Laboratories, Shows How This Is Accomplished

Over two years ago Bell Telephone Laboratories demonstrated a practical system of television. For the first time successful representations of objects at rest or in motion were transmitted electrically—over wires or through the ether—for considerable distances. The reproduction of the scene then transmitted was in monochrome—the orange-red color of the neon lamp. Recent developments of the Laboratories, however, have made it possible to reproduce scenes with their true color values. The appearance of reality in the reproduced scene is thus greatly enhanced.

One of the most significant features of this new achievement is that it does not require completely new apparatus. The same light sources, driving motors, scanning discs, synchronizing systems, and the same type of circuit and method of amplification are used as in the monochromatic system. The only new features are the type and arrangements of the photo-electric cells at the sending end, and the type and arrangements of the neon and argon lamps at the receiving end. The outstanding contributions that have made the present achievement possible are a new photo-electric cell, new gas cells for reproducing the image, and the equipment associated directly with them.

To render the correct tone of colored objects, it was necessary to obtain photo-electric cells which—like the modern orthochromatic or panchromatic plate—would be sensitive throughout the visible spectrum. This requirement has been satisfactorily met. Through the work of A. R. Olpin and G. R. Stilwell a new kind of photoelectric cell has been developed, which uses sodium in place of potassium. Its active surface is sensitized by a complicated process using sulphur vapor and oxygen instead of by a glow discharge of hydrogen as with the former type of cell.

The response of the new cell to color, instead of stopping in the blue-green region, continues all the way to the deep red. Because the former potassium cells were responsive only to the blue end of the spectrum, objects of a yellowish color appeared darker than they should have and the tone of the reproduced scene was not quite correct. This disadvantage applied particularly to persons of dark or tanned complexion. When the new cells are used in the original television apparatus and with yellow filters—similar to those used in photographing landscapes in order to make the blue sky appear properly dark—this defect is corrected and the images assume their correct values of light and shade no matter what the color of the object or the complexion of the sitter. It is the availability of the new photo-electric cells which makes color television possible by their use.



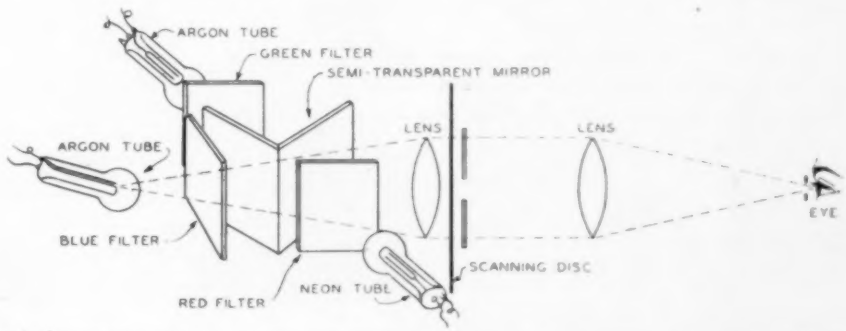
The grouping of the colored filters in front of the color-sensitive photo-electric cells is shown in this perspective sketch of the television transmitter.

The development of color television has been greatly simplified by the fact that as far as the eye is concerned any color may be represented by the proper mixture of just three fundamental colors—red, green and blue. This fact was utilized in the development of color photography, and all the research that had been done in that field was available as background for color television. A host of methods of combining the three basic colors to form the reproduced image was available but, insofar as the sending or scanning end is concerned, a method was developed which has no counterpart in color photography. The method of "beam scanning"—used in the first television demonstration*—has been employed.

*Bell Record, June, 1928, page 325.

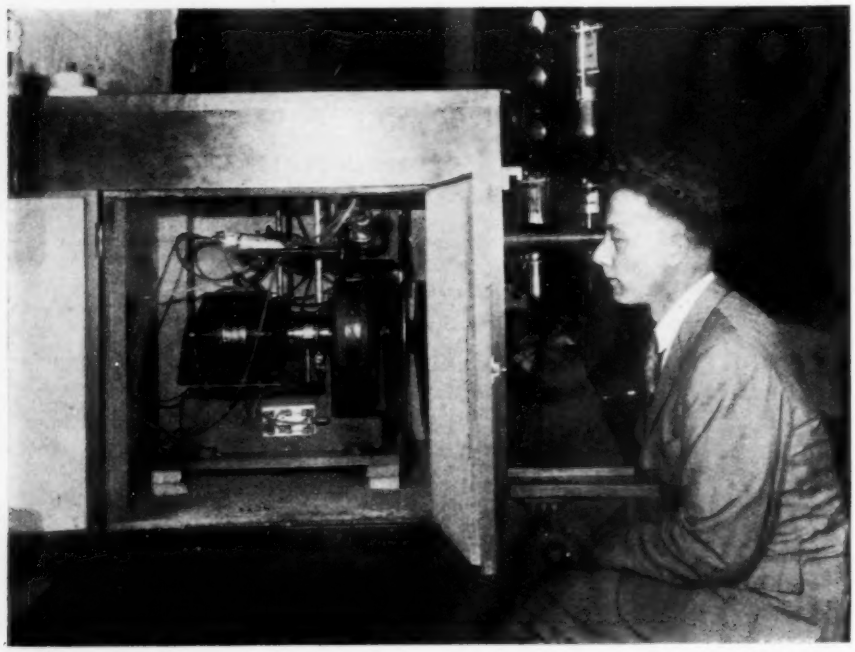
To apply this method to color television, three sets of photo-electric cells are employed in place of the one set used before. Each of these sets is provided with color filters made up of sheets of colored gelatine. One set has filters of an orange-red color which make the cells see things as the hypothetical red sensitive nerves of the retina see them; another set has yellow-green filters to give the green signal, and the third set has greenish-blue filters which perform a corresponding function for the blue constituent of vision. The scanning disc and the light source are the same as with the beam scanning arrangement used in monochromatic television. The only difference is in the photo-electric cells, and thanks to the tri-chromatic nature of color vision, it is only necessary to have three times the number of cells used previously to reproduce all colors. Three series of television signals, one for each set of cells, are generated instead of one and three channels are used for the transmission of the television signals.

The photo-electric cell container, or "cage," has been built in a somewhat different form from that used in our first demonstration. There three cells were used arranged in an inverted "U" in a plane in front of the object. In the new photo-cell cage twenty-four cells are employed, two with "blue" filters, eight with "green" filters, and fourteen with "red" filters. These numbers are so chosen with respect to the relative sensitiveness of the cells to different colors that the



One semi-transparent mirror reflects red light from the neon tube; one reflects green light from one argon tube, and through both mirrors passes blue light from the other argon tube.

photo-electric signals are of about equal value for the three colors. The cells are placed in three banks, one bank in front of and above the position of the scanned object, one bank diagonally to the right, and another bank diagonally to the left, so that the cells receive light from both sides of the object and above. In placing the cells they are so distributed by color as to give no predominance in any direction to any color. In addition large sheets of rough pressed glass are set up some distance in front of the cell containers so that the light reflected from the object to the cells is well diffused.



Side view of receiving apparatus with doors of cabinets opened. All but the argon tubes and the box containing semi-transparent mirrors and filters are the same as for the original demonstration of monochromatic television.

The television signals produced in the color sensitive photo-electric cells through the color filters are no different electrically from those used in monochromatic television. Three sets of amplifiers are required, one for each color, and three communication channels in place of one, but the communication channels are exactly similar to those which were used with the same scanning disc before.

For color television the three images must be received in their appropriate colors, and viewed simultaneously and in superposition. The first problem was to find light sources which, like the neon lamp previously used, would respond with the requisite fidelity to the high-frequency signals of television, and at the same time give red, green and blue light. With such lamps available a decision would have to be made as to how the three colors could best be combined to form a single image.

Several methods of reception are possible. For displaying the transmited image to a large audience a grid* could be employed similar to that used for the earlier demonstration but it would consist of three parallel tubes instead of a single one.

*Bell Record, May, 1927, page 319.

Thus far the television images have been received in a manner similar essentially to our method for monochromatic television. The surface of a disc similar to that used at the sending end is viewed, and the light from the receiving lamp is focussed on the pupils of the observer's eye by suitable lenses. To combine the light of the three lamps, they are placed at some distance behind the scanning disc and two semi-transparent mirrors are set up at right angles to each other but each at 45° to the line of sight. One lamp is then viewed directly through both mirrors and one lamp is seen by reflection from each, as illustrated by the accompanying diagram.

The matter of suitable lamps to provide the red, green and blue light has required a great deal of study. There is no difficulty about the red light because the neon glow lamp which has been used previously in television can be transformed into a suitable red light by interposing a red filter. For the sources of green and blue light nothing nearly so efficient as the neon lamp was available. The decision finally made was to use another one of the noble gases—argon—which has a very considerable number of emission lines in the blue and green region of the spectrum. Two argon lamps are employed, one with a blue filter to transmit the blue lines and one with a green filter transparent to the green lines of its spectrum.

These argon lamps unfortunately are not nearly so bright as neon lamps and it was, therefore, necessary to use various expedients to increase their effective brilliancy. Special lamps to work at high current densities were constructed with long narrow and hollow cathodes so that streams of cold water could cool them. The cathode is viewed end-on. This greatly foreshortens the thin glowing layer of gas and thus increases its apparent brightness. Even so it is necessary to operate these lamps from a spe-

(*Continued on page* 44.)

Side view of sending apparatus with doors of cabinet opened. With the exception of the photo-electric cabinet at the left, the apparatus is identical with that used for the original demonstration of monochromatic television.

Telephone Transmission

{ The Following Very Able Article, Furnished by Mr. B. C. Burden of the Lincoln Telephone & Telegraph Company, Furnishes Some Interesting Information on This Subject }

General

The term "transmission" as it is used in the telephone industry refers to the passage of the voice from one point to another via some conducting medium.

Transmission is said to be good or bad depending upon the volume of the received sound and the accuracy with which the reproduced voice represents the original.

It is *telephone transmission* that the subscriber pays for and it is telephone transmission by which they generally judge the company furnishing them with telephone service.

Competent observers have determined that a subscriber's adverse reaction to any deficiency in transmission is much more severe than to any other fault to which a telephone system may be afflicted.

A telephone subscriber will excuse complete interruption of service; he will in some cases condole discourtesy on the part of an operator, but many years of dealing with the telephone using public has taught some of us that the subscriber will, as a rule, consider any poor transmission to which he may be subjected as sufficient reason for condemning the entire system.

We will not attempt to analyze this rather unusual viewpoint of the average subscriber but can more profitably devote our time to a consideration of ways and means of measuring transmission, so that faulty transmission complaints will be kept at a minimum.

A Unit of Transmission

In order to measure anything quantitatively we first must have a unit. Units are merely arbitrary designations for certain definite quantities of the thing with which we are dealing. For example a pound is a unit of weight. It was decided by someone many years ago that the mass which we now know as the pound was a convenient amount with which to deal and it was therefore given a name to identify it, and became an established unit.

In the early days of the telephone art it was realized that a unit was needed so that the effect of various transmitting mediums upon the voice currents passing through them, could be determined in terms of the unit. The necessity for setting up standards of transmission so that the service rendered would be more or less uniform over the country also made a suitable unit desirable.

The Mile of Standard Cable Unit

The first unit selected and which was used in both this country and abroad for many years, and which is still in use to some extent, was the "mile of standard cable."

This unit is represented by one mile of No. 19 gauge cable having electrical characteristics of 88 ohms per mile, and a capacity of .054 m.f. between the wires of the pair.

A mile of No. 19 gauge cable was selected as a unit because of the large amount of this type cable in use at the time the unit was set up. It was thought that it would be a unit which would have physical significance to the men in the field, and therefore be more usable and understandable.

Before discussing the methods used for measuring transmission in terms of the "mile of standard cable" let us consider the uses to which a unit of transmission may be adopted.

Uses of Transmission Units

There are three general uses for a unit of transmission, viz:

1. To express the relative talking efficiencies of telephone apparatus in terms of the unit. For example a circuit mile of No. 12 (.109) iron wire has a talking efficiency of .28 miles of standard cable. This relative talking efficiency of the various parts of telephone plant is usually referred to as the "transmission equivalent." That is, the "transmission equivalent" of No. 12 iron wire would be .20 m.s.c.

2. As a basis for the transmission standards that are set up. Transmission standards in this country are established at 20 m.s.c. for local calls, and 30 miles for toll calls. That is, the overall loss on a local call should not exceed the loss that would normally be experienced in talking through 20 miles of No. 19 ga. cable, or 30 miles in the case of toll calls. Telephone plant engineered on this basis should give satisfactory volume under normal conditions.

3. A third use of the unit which might not come under either of the above uses is the expression of the talking efficiency of working lines and apparatus, this value being determined by measurement.

Transmission equivalents are important factors in the design of new telephone plant as they enable the designer to pick the proper type wire or cable which will best satisfy the constructional requirements and yet be adequate from a transmission standpoint.

The writer knows of one specific case where a wire chief placed several miles of small gauge cable out into the rural district, thinking that his troubles from wire maintenance were over, but after he had cut the cable into service found that many of the subscribers could hardly talk through the cable. Had this wire chief been familiar with transmission equivalents of 24 gauge cable he would not have attempted to replace a conducting medium having an equivalent of .28 m.s.c. with one having 1.91 m.s.c. per mile.

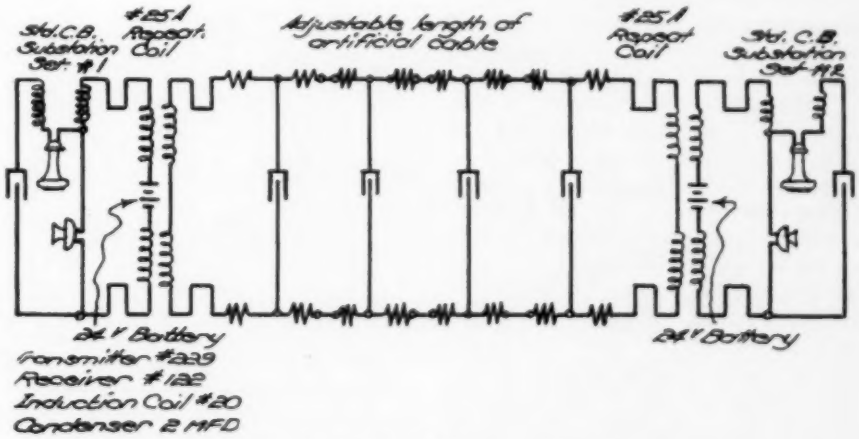


Fig. 1—Standard Reference Circuit

Transmission Reference System

Telephone transmission might be said to be a relatitve quantity. That is, we usually desire to know what the transmission under some new or existing condition would be as compared to some reference transmission with which we are familiar. For example, a wire chief in a

small exchange may never have heard of transmission units, or transmission reference systems, and yet he has a "subconscious" reference system of his own. When he listens over a line which he is testing he observes the transmission as being good, poor, bad, etc. His instinctive reference system probably consists of some telephone connection over which he talks quite frequently and which has good volume and talks up clearly and distinctly.

Looking back over "wire chief days," I recall that I was inclined to compare and gauge all transmission in terms of that obtained over my office telephone when connected to a telephone in my residence. Both were new Western Electric instruments on a short loop, and I naturally assumed that this must represent 100% talking efficiency, and so accordingly judged all other transmission by reference to this particular connection.

A preceding paragraph stated that the "Standards" for this country are 20 m.s.c. for local and 30 m.s.c. for toll calls. It is obvious that these standards are more or less vague unless we refer them to some reference condition. The engineers who established the m.s.c. unit at the same time set up or established what was known as the "Standard reference system." This circuit consisted of two Western Electric subsets (common battery) equipped with a No. 122 W. E. receiver and a No. 229 W. E. transmitter and a No. 20 induction coil. The sets were connected together on a zero loss loop and fed with 24 volt battery supply through a W. E. 25-A repeating coil. The volume of transmission or rather the volume of the received voice when talking over one set and listening over the other was said to represent zero loss. Now all transmission regardless of the conducting medium is referred back to this circuit.

Fig. 1 shows a standard reference circuit connected to an artificial cable box. The artificial cable box is merely an arrangement of resistances and condensers which may be cut in and out of circuit by switches and which will give the same effect as an equivalent number of miles of No. 19 gauge cable. To further explain the "transmission reference circuit" suppose we talk over subset No. 1 to subset No. 2 with the artificial cable cut out of circuit. The received volume in this case would be equivalent to zero miles of standard cable or stating it differently the transmission equivalent of the circuit would be zero m.s.c. Now if we connect into the circuit between the two subsets a mile of artificial cable then the received volume on subset No. 2 would be equivalent to 1 m.s.c., that is, we could say that the overall transmission equivalent of the artificial cable and the two subsets is one m.s.c.

Therefore when we talk about the transmission equivalent of No. .109 iron wire as being .28 m.s.c. we are actually stating the effect that a mile of iron wire would have if placed in the standard reference circuit as compared to the effect of a mile of No. 19 gauge cable.

It is important to grasp the point that while a mile of standard cable would always be said to have a transmission equivalent of 1 m.s.c.; yet if we should connect to a mile of standard cable subsets having efficiencies different from those in the standard reference circuit, then the overall transmission equivalent would be either greater or less than 1 m.s.c. This would depend upon whether the subsets used had a higher or lower efficiency than the standard reference subsets.

For example, if we should substitute a

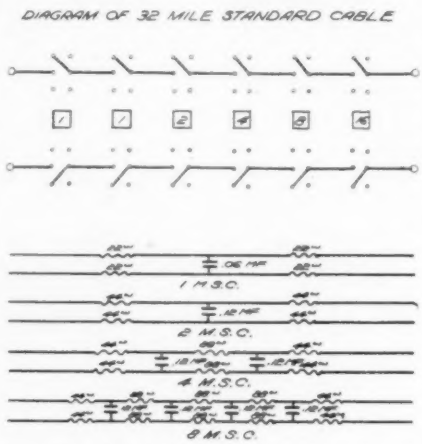


Fig. 2—Artificial Cable Boxes

W. E. No. 323 transmitter to replace the No. 229 in the standard reference circuit and had one mile of artificial cable cut in (see Fig. 3) then the overall transmission equivalent of this set up would be negative 1.08 m.s.c. That is, the No. 323 transmitter is 2.08 m.s.c. better than the No. 229, hence its substitution in the standard reference circuit would give the same volume of transmission over 3.08 m.s.c. as the No. 229 would over 1 m.s.c.

Artificial Cable Boxes and Talking Tests

There are two ways by which the relative transmitting efficiency of a line or piece of apparatus may be determined, viz: By mathematical computations or by comparison of the lines or apparatus with a variable number of the standard units.

The latter method will be discussed here as mathematical treatment is not feasible for general purposes. One of the early methods of transmission testing which is still used to some extent was an arrangement similar to that shown in figure three, except that the line or apparatus under test was arranged to be cut into circuit in place of the artificial cable by means of double pole switches.

In this set up, which we will classify as the "voice method" to distinguish it from other methods which we will describe, the efficiency of the circuit under test is determined by balancing it against a variable artificial standard cable. This is accomplished by having two testers, one to talk and one to listen. Tester A talks into his subset and alternately throws his set back and forth between the artificial cable and the circuit under test. Tester B, who is located in an adjacent room throws his switch at the same time as Tester A and alternately listens on the artificial and the circuit under test, noting the difference in the volume received over each circuit. Tester A next cuts artificial cable in or out of circuit until the volume over the two circuits is the same. When a balance of the received volume is obtained, then the transmission equivalent of the circuit under test may be read directly from the artificial cable box by noting the number of miles of cable cut in.

Early Artificial Cable Boxes

The early test sets of this type were composed of one- two- four- and eight-mile units of artificial cable and by means of switches (see Fig. 2) the number of miles of cable in series with the in and out binding posts could be varied in one (1) mile steps.

Voice testing is both slow and laborious and requires considerable care in observing and balancing if accurate results are to be obtained. Where only a few lines are to be tested or measured and where a small organization is involved this method serves as a cheap and sufficiently accurate means of measurement, but with the larger companies having a great number of lines and offices to check some more rapid

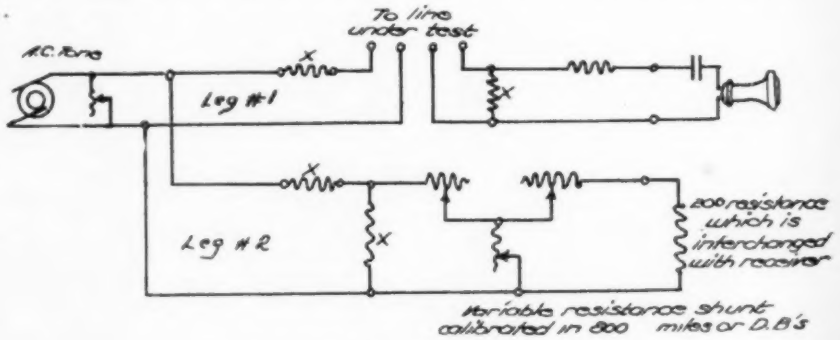

To line under test
A.C. Source
Leg #1
Leg #2
200 resistance which is interchanged with receiver
Variable resistance shunt calibrated in 800 miles or D.B's

Fig. 3—Ear Balance Transmission Test

and accurate method is desirable. The larger companies realizing this some years back perfected a transmission measusing set which worked on somewhat different principles than the set described above. The new method, which will be described later, replaced the use of the voice with an alternating current of constant frequency.

Voice testing, however, is still the best method for testing transmitters as there is a tendency for transmitters to pack and give inaccurate measurements when they are driven by a constant frequency acoustic generator, i.e., by placing a receiver connected to a source of oscillating current in front of the transmitter to be tested.

When voice testing is used, the following points should be observed:

1. The tester at the transmitting end must maintain the same voice level all during the test.

2. The lips should remain a fixed distance from the transmitter when talking.

The 800 Cycle Mile

The "mile of standard cable unit" as used in connection with voice testing has several disadvantages. In the first place it requires two testers, one to talk and one to listen. Then it is impractical to maintain a constant sound input to the transmitter as the tester's voice will vary somewhat and a shift in position before the transmitter may bring about a considerable change in the transmitter output.

Another equally important disadvantage of the "mile of standard cable" unit is its variation with frequency. Being composed of a capacity and resistance network, it is apparent that the higher frequencies would be attenuated more than the low in passing through an artificial m.s.c. measuring set.

This "distorting" effect was not particularly objectionable when testing was done by voice, but as the use of voice testing was abandoned in favor of constant frequency drivers, it became apparent that a new unit was needed. This point will be made clear by considering the following comparison.

Attenuation of 1 Mile Standard Cable

Voice Frequency—1 m.s.c.
200 Cycles—.51 m.s.c.
800 Cycles—1.01 m.s.c.

In consideration of these disadvantages it was felt that a new unit should be set up.

In selecting a new unit for transmission measurements, it was desirable to adopt one which would not be materially different in effect on transmission from the old m.s.c. unit which has been in use for many years. The unit selected was named the "800 cycle mile" and was approximately the same in effect on transmission as the old m.s.c. You will note that in the above comparison of the attenuation of a m.s.c. at different frequencies that the attenuation at 800 cycles is 1.01 m.s.c., that is 800 cycles represents approximately the effect of the voice.

The "800 cycle mile" unit is technically defined as the attenuation of 1 mile of standard 19 gauge cable to an alternating current of 800 cycles.

Constant Frequency Measuring Sets

At the same time the "800 cycle mile" came into use as a unit, the old artificial cable measuring box was replaced by a new measuring set known as the 1-A Transmission Measuring Set (W. E. manufacture). The new set was designed for a constant frequency drive instead of voice and was calibrated in "800 cycle miles." The range of this set was 56 miles in ½ mile steps.

Fig. 3 shows the schematic wiring of the 1-A set. Essentially it consists of two legs or branches which are bridged together at one end. An alternating current source is connected across this bridged point so as to impress the same a. c. potential across both branches. One of the branches has connected in it a variable shunt and series resistance network, the operating dial of which is calibrated to read in "800 cycle miles." The other branch is wired to terminals to which the line or apparatus under test may be connected. By means of a double pole double throw switch, a receiver may be thrown rapidly from one branch to the other.

In operation the circuit to be measured is connected to leg No. 1 and a source of 800 cycle a. c. to terminals marked a. c. input. The tester then listens on first one leg and then the other and adjusts the receiver shunt until the volume response in the two branches are exactly equal.

The transmission equivalent may then be read directly from the calibrated dial in terms of "800 cycle miles." The receiver and condenser are interchanged for the 200 ohm resistance when throwing from one leg to the other. This is necessary in order to keep the load on the two legs the same regardless of the position of the receiver. The combination of receiver and condenser are approximately equal in impedance to the 200 ohm resistance.

The resistances marked X are variable in three steps by means of switching keys and are necessary in order to match the impedance of the test set to that of the line under test. Lines or apparatus are classified as low, medium, or high impedance. Open wire and non-loaded cable fall into the low impedance class, while medium and heavy loaded cable fall into the low impedance class, while medium and heavy loaded cable fall into the other two classes.

This impedance match between the measuring set and circuits is necessary to avoid losses due to reflection effects which would not give the correct equivalent of the circuit under test.

The variable resistance marked a. c. control is used to vary the potential applied to the two branches, to an amount best suited to the tester's ear. It should be appreciated that a variation in the magnitude of the a. c. potential impressed across the two branches will not affect the measurement as the potential across both branches is identical, and the test being a relative one, the answer will be the same regardless of input. This adjustment is made to suit the tester's ear.

Uses of 1-A Transmission Measuring Set

The 1-A set is used for making transmission measurements of central office apparatus, toll lines, inter-office trunks, and, in some cases, subscribers' lines. This method of transmission measurement is referred to as the "ear balance method."

In toll or trunk testing it is necessary to loop the distant end of the circuit to be tested back to the office from which the test is being made by means of a second circuit. If the circuits used are both of the same gauge conductor, then the measured reading will need to be divided by two to give the average equivalent of each circuit. If the exact equivalent of one of the circuits is required, then it is necessary to utilize a third circuit. The circuit under test is looped back first over one of the auxiliary circuits and then the other. Then by means of the well-known "triangulation" formula, the exact equivalent of the desired circuit can be obtained.

(*Concluded in September issue.*)

Company Fails to Exercise Purchase Option

The proposed sale of 10,000 shares of the common stock of the United Telephone Company, of Bellefontaine, Ohio, was not completed at the postponed date, July 1, set.

At the meeting of the Board of Directors of the United Telephone Company no action was taken by the Board regarding the matter.

Consolidated Absorbed by Bell Phone System

(Danville, Ill., Gazette)

The Consolidated Telephone Co. has been taken over by the Bell Telephone system, on an order approved by the Public Service Commission. Six other telephone systems in the state also were taken over by the big company, the switchboards being located at Michigan City, Columbus, Martinsville, Clinton, Bloomfield and Rockville. Jere West of Crawfordsville, new member of the commission, wrote the order, while Frank T. Singleton of Martinsville, who is slated to retire, dissented from the action of the majority of the Commission.

Studying Telephone Methods

This Is Chapter 30 of a Series of Articles by E. R. Collins, Manitoba Telephone System, Brandon, Manitoba, Canada. Circuit Arrangements Discussed in This Article

Wiper and Bank Assembly.

The previous chapter described some of the possible ways of changing electrical impulses into mechanical motion. The motion of the ratchet wheel is in a rotary direction. The motor magnet therefore can be called the rotary magnet. On the same shaft with the ratchet wheel we can mount springs insulated from the shaft, but securely bolted to it, so that the springs turn in step with the ratchet wheel.

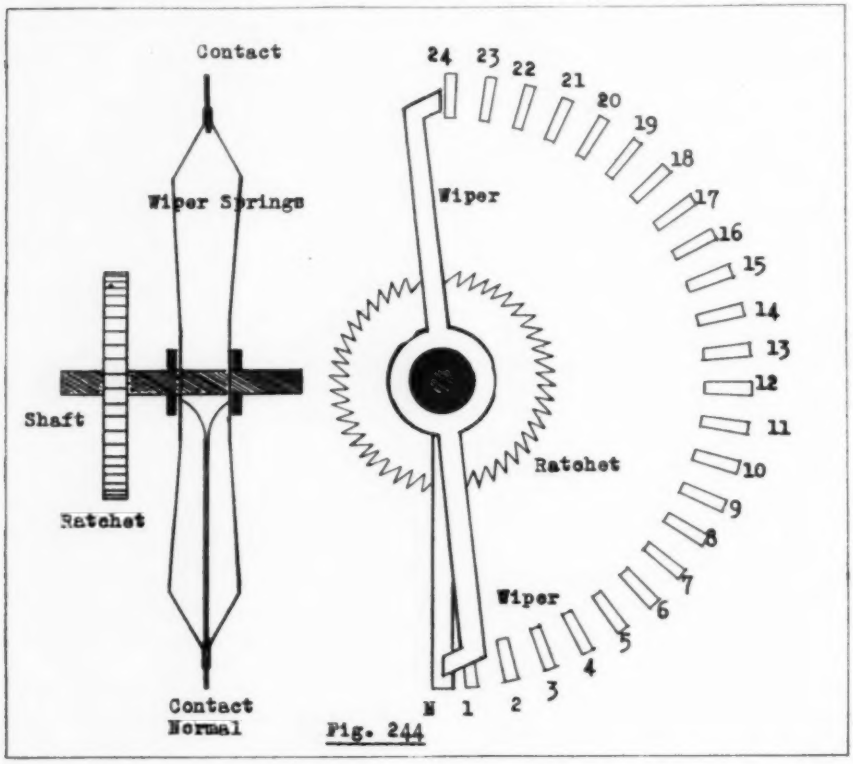


Fig. 244

In Fig. 244 we have the side view, and cross section view of a typical spring assembly on a rotary shaft. There is also a set of 24 short pieces of metal set in a half circle and numbered. These are contacts, and are set between insulating material, and clamped between metal half circles. This forms what is termed a *contact bank*.

Normal Contact.

Looking at the left hand drawing, it will be noted that the two outside springs are called *wiper springs* or commonly just *wipers*. Between the lower end of the wiper tips is shown the normal contact. This contact is formed of two pieces of phosphor bronze, and extends upward almost to the shaft. The tips of the normal contact are curved outward, and press against the inner surface of the wipers. The part of the wipers where the normal contacts press is in the form of a circle as will be noted from the right hand drawing. The normal contact springs will therefore always be in contact with the inner circle surface of the wipers regardless of the position of the wipers in the circle of its rotation. Therefore if the tips of the wiper are resting on any contact (5 for example) the normal contact will still be in contact with the wiper springs. The wiping motion of the normal contact against the wipers will keep the contact clean.

There must however be a proper amount of outward tension placed on the tips of the normal contact springs. There is also tension of one wiper tip against its mate. If the one wiper spring is moved outward at the tip, its mate should follow it at least ¼". This follow of the springs must be equal. That is if the right hand wiper tip is moved to the right, the left hand wiper tip must follow it ¼". If the left hand wiper tip is moved to the left, the right hand wiper tip must follow it ¼" also. The follow up in each case should be the same.

It will be noticed that the end of the wiper marked "X" will pass over all the bank contacts while the ratchet wheel makes one half revolution. The other end of the wiper springs will make contact with the bank contacts during the other half of the revolution.

When the wipers are in the normal position the wiper tips are clear of all contacts except the normal contact. Any other position of the wipers would be called an *off normal position*.

The adjustment of the pawl, front and back stops must be such that the tips of the wiper springs will always cover the bank contact when the wheel is not in motion. The length of the tooth of the ratchet wheel must be such that the wiper springs will have the same relation to every contact, for every position of the ratchet wheel. There will be twice as many teeth in the ratchet wheel as there are bank contacts.

Impulse Relay Set.

In Fig. 245 is shown the circuit of the relay set required to operate the rotary magnet. The relays and rotary magnet are designed to operate from 12 volt battery. The current flow from this battery through the line or "A" relay will be 80 mil amperes. The resistance of the line and the telephone will reduce this current flow, so that if "A" is held operated for a long time, the coils would not overheat.

It is customary to letter the relays as shown in Fig 245, and the "A" relay is commonly mentioned when the line or impulse relay is meant. The "A" relay is a quick pull up and quick release as it must respond quickly to the impulses sent from the calling device shown in the same drawing. The shunt springs are omitted from the calling device in this drawing for simplicity.

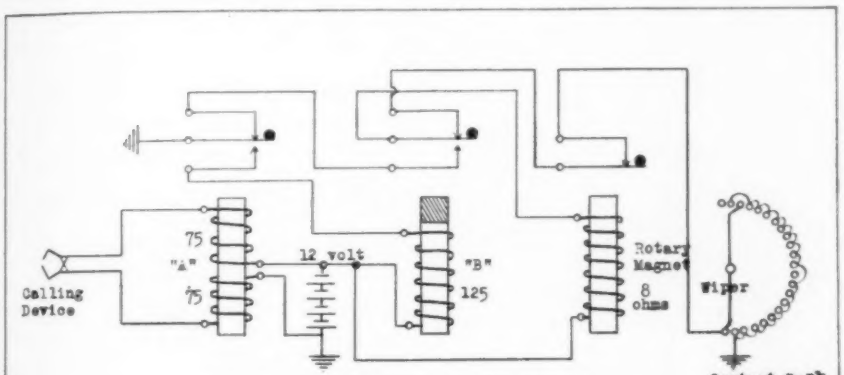
The next relay is the "B" relay. This is a slow release relay as designated by the shaded portion of the core. This marking indicates the slug is on the end of the core away from the armature. The marking for the slug on the opposite end will be shown when we have occasion to use such a relay. The resistance of the "B" relay is 125 ohms. This will allow 60 millamperes of current to flow. This amount of current will not overheat the coils when operated for a long time.

Impulsing.

When the circuit to "A" is closed, its armature pulls in. Springs 1 and 2 make contact and complete the circuit for the

battery to flow from relay "B" to Pos. battery or ground. Relay "B" will then pull up its armature. A circuit can now be traced from negative battery through the 8 ohm rotary magnet, make contact of springs 1 and 2 relay "B" to the break contact of "A" spring No. 3. But there is no contact here as "A" is operated.

Now let "A" release for a part of a second. Then the battery will flow from the rotary magnet to ground at "A" springs 2 and 3 now in contact. This will pull up the rotary magnet once. Then "A" closes again and breaks the circuit to the rotary magnet and it releases. The slow release feature of "B" prevents it from dropping out when "A" is open during the impulse period. Therefore relay "A" may open and close rapidly in step with the impulses from the calling device, and "B" will hold the circuit to the rotary magnet.



Set of Impulse Relays with Rotary Magnet

Fig. 245

The calling device must open "A" long enough to allow the rotary magnet to become fully saturated, so that it will make its full stroke and allow the pawl and dog action to operate the ratchet wheel one tooth. If the length of time is too short the rotary magnet will not operate the full stroke, with the result that the ratchet wheel will turn the length of part of a tooth and drop back again. The wipers of course will then drop back on the same contact. This may be termed a weak impulse. On the other hand if the length of time "A" remains open is too long the release time of the "B" relay will be increased, and "B" will drop out between impulses. If "B" drops out, of course the circuit to the rotary magnet is opened, and the rotary motion is again spoiled. Therefore there must be a correct division of time between the operate and non-operate periods of the "A" relay when the impulses are being sent from the calling device. The shape of the cam wheel largely determines this division of time.

The bank contacts are shown grounded, with the exception of the contacts 10 and 20. Let us first consider the effect with these two contacts also grounded. The wipers have been driven say to contact 5 of the bank. Then the line to "A" is opened. "A" will release and break the circuit to "B." After a slight delay "B" also will release. Now a circuit can be traced from the negative battery of the rotary magnet through normal contact (2 and 3 of relay "B"), through the interrupter springs of the rotary magnet to the normal contact of the bank, through the normal contact spring tips, to the wiper spring, to contact No. 5 of the bank to ground or positive battery. This will pull up the rotary magnet. As soon as the rotary is pulled up full the interrupter springs opened by the rotary armature will open this circuit and the rotary armature will release. The wipers now stand on contact No. 6. But this is also grounded and the operation is repeated until passing from contact to contact the wipers are driven clear of the grounded contacts, and rest on the normal contact again.

If we wish to drive the wiper to contact 7 we send 7 impulses from the calling device. But the calling device can only send 10 impulses at a time. Therefore to stop on contact 17 we would have to first send 10 impulses, and then again another 7 impulses. The directory listing of a telephone connected to contact No. 17 would then read No. 07.

Connector Switch.

In Fig. 247 we have a circuit of a connector for a 12 volt telephone exchange. This type of equipment is used for small isolated plants where only a limited number of telephones is required. This system has a possible capacity for 22 telephones.

The rotary magnet shaft is equipped with *four* sets of wipers, each set of course insulated from the other on the shaft. Then there are *four* sets of banks, one for each wiper, mounted on a common framework so that the banks and the wipers are properly in line as, for example, the left hand arrangement in Fig. 244.

The upper bank in Fig. 247 is called the negative bank, the lower one the positive bank. Then there are two other banks called the private 1 and private 2 or P1 and P2, respectively. The purpose of the negative and positive banks is to make the actual connection to the telephone called, while the P1 is to return the shaft to its normal position from any contact, and P2 is to test the calling line for a busy condition, and also to busy a line when in use.

There are 4 relays and the rotary magnet and wipers for each telephone. Therefore 22 telephones would have 22 of such sets of equipment. The use of this equipment for each telephone makes it rather expensive so that only on small systems would this system be employed.

The Telephone.

The arrangement of the telephone is different to the ordinary type. There is the transmitter receiver and bell, with the calling device and hook switch. There is also added a push button for ringing. The one shunt spring of the calling device is grounded as well as one spring of the push button. The bell ringer coils are also taken to ground from the hook switch. The bell coils are not shown in the drawing due to lack of space. The ground to the telephone may be made to a water pipe or radiator, or if not too far from the switchboard can be wired from the terminal of the switchboard with three conductor wire.

The calling telephone and the relay and wiper equipment shown in Fig. 247 then are wired as one piece of apparatus. The called telephone is shown by the dotted lines at the right of the drawing. The calling telephone is No. 15 or rather No. 05 since 10 impulses are required to step the wipers around 10 steps.

Relay Equipment.

The relay equipment may be mounted separate from the rotary magnet and wiper and bank apparatus, or may be included on the one mounting. In Fig. 246 the battery feed to the telephone was supplied through a double wound relay "A". In Fig 247 the battery feed to the telephone is supplied through two equal impedance relays *A* and *C*. Relay "A" is the negative relay and relay "C" is positive. When the receiver at telephone 05 is removed therefore battery will flow from negative battery through relay "A," over the line through the impulse springs of the calling device, through transmitter and receiver in series, through push button and hook switch make contacts to ground through winding of relay "C." Relay "A" pulls up and closes the circuit to relay "B."

Relay "B" pulls up and prepares a circuit from negative battery at the rotary magnet through contact (1 and 2 of B), through normal contact (3-4 of "D"), back to the No. 3 spring of relay *A*. This spring is now dead since "A" is operated

Relay "C" is also operated, and closes a circuit for the busy test from ground at the busy test induction coil, through

Jamestown Orders

The Handsome New Building of the Jamestown Telephone Corporation, Jamestown, N. Y., Which Company Recently Announced Its Adoption of Strowger Automatic Dial Operation.

The New Toll Board for the Jamestown Telephone Corporation Will be Similar to This 16-Position Toll Board also Furnished and Installed by Automatic Electric Inc.

STROWGER

DIAL SY

ers Position Toll Board

When the Jamestown Telephone Corporation of Jamestown, N. Y., placed orders with Automatic Electric Inc. for the conversion of its entire telephone system to Strowger Automatic Dial operation, the plans which were made included the modernization of the complete plant. Under the far-sighted direction of John H. Wright, vice president and general manager of the company, only the best and most modern telephone equipment has been selected for this purpose.

Thoroughly in line with this policy has been the Jamestown Telephone Corporation's selection of Automatic Electric Inc. to furnish and install complete the 24-position toll board to be placed in the new building, together with all special desks for auxiliary services. This company, as well as converting hundreds of exchanges throughout the world to Strowger Automatic Dial operation, has also furnished and installed many toll boards, the newer ones incorporating C. L. R. and other up-to-date service features, and embodying everything that is best in both construction and materials.

All of the many advantages which result from thorough coordination and unified engineering will accrue to the Jamestown Telephone Corporation in the efficient and economical operation of its entire network in the years to come.

Automatic Electric Inc.

Manufacturers of

STROWGER AUTOMATIC DIAL TELEPHONE AND SIGNALING SYSTEMS

Factory and General Offices: 1033 West Van Buren Street, Chicago, U. S. A.

Sales and Service Offices in All Principal Cities

EXPORT DISTRIBUTORS

For Australasia	Automatic Telephones, Ltd., Sydney
For Canada	Independent Sales and Engineering Co., Ltd., Vancouver
Elsewhere	The Automatic Electric Company, Ltd., Chicago

ASSOCIATED COMPANIES

American Electric Company, Inc.	Chicago
International Automatic Telephone Company, Ltd.	London
Automatic Telephone Manufacturing Company, Ltd.	Liverpool
The New Antwerp Telephone & Electrical Works	Antwerp

WGR AUTOMATIC

L SYSTEMS

the make contacts (4 and 5 of C), through the 250 ohm winding of "D," through normal contacts (8 and 9 of "D") to the wiper P2. But wiper P2 is standing on its normal contact which leaves the wiper dead.

The calling device is operated. Then battery from relay "A" will flow over the negative line to the calling device. the battery now flows to ground through relay "C," which pulls up again. This closes contacts (4 and 5 of C) and opens up contacts (2 and 3 of C), leaving the generator circuit open.

Busy Test.

Now a circuit can be traced from the ground at the busy test induction coil, through make contacts (4 and 5 of C),

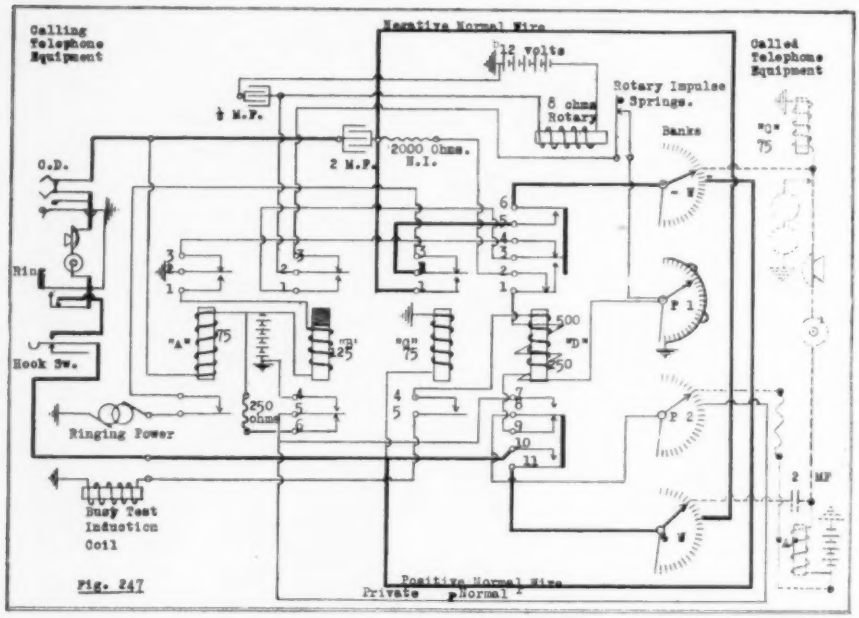


Fig. 247

But the shunt springs are now closed, so that battery will flow back over the lowest resistance path to ground, and there will be practically no current flowing through relay "C" winding to ground. Relay "C" not receiving enough current to hold its armature operated, releases. When "C" releases it cuts off the busy test but a circuit from the ringing generator is completed through make contacts (4 and 5 of relay "A"), through normal contacts (2 and 3 of C) to contact 5 of relay "D." But "D" is not operated yet so that contact 5 is dead. The impulse springs of the calling device are operating say Figure "0" or sending 10 impulses. This will drive the wipers on to contact 10 of the banks. But these contacts are left dead on the negative and positive banks, also on the "P2" bank. Therefore the wipers of these banks do not complete any circuit, and no change takes place in the relay circuits. Then the next digit "5" is operated, and the wipers are driven on to contact No. 05. This is the number of the telephone that is calling which will of course be the same as though it were busy. Now there is a wire connected to the P2 contact No. 05 which is called the *private normal* and leads back to the No. 5 contact of the "B" relay of the line that is calling. Relay "B" will be operated since it fails to fall back while relay "A" is impulsing, therefore contact (5 of the relay B) will be grounded. As soon as the impulses cease, the ground is removed from the calling device, and through the 250 ohm winding of relay "D," through normal contacts (8 and 9 of D) to P2 wiper which is grounded over No. 05 contact back to ground at relay "B," which is operated. There is no battery flowing through the winding of "D" at this time, and the high frequency busy current is too weak to cause the armature of "D" to operate. Now there is a second 500 ohm winding on relay "D," which would naturally have a relatively greater number of turns than the 250 ohm winding. Therefore we have the requirements of a step up transformer. The 250 ohm winding induces a current in the 500 ohm winding. The lower end of the 500 ohm winding is connected to wiper P-1, which being in the off normal position resting on contact 05 will be grounded. A circuit can therefore be traced from ground at P-1 back through the 500 ohm winding of relay "D" through normal contacts (1 and 2 of D), through the 2,000 ohm non-inductive resistance, through the 2 M. F. condensers, through the calling telephone with its receiver, back to ground at relay "C" windings. This sets up a busy tone in the receiver of the called telephone. The subscriber therefore will hang up the receiver. As soon as the receiver is replaced, relays "A," "B" and "C" all release. Now all the contacts of bank P-1 are grounded, except the normal contact. Therefore a circuit will be completed from ground to P-1 through the rotary impulse springs of the rotary magnet, through normal contacts (2 and 3 of B), through the rotary magnet to negative battery, bringing into effect the buzzer action which will return the wipers to normal.

Ringing.

If we should now call line No. 08. The operation of the "A," "B" and "C" relays will be the same as before. But wiper P2 is now on contact No. 08. This contact is connected through a 250 ohm resistance to negative battery. A similar resistance can also be seen in Fig. 247 connected to No. 6 contact of relay "B." The called telephone will have a set of relays the same as the calling telephone, therefore the resistance connected to No. 08 as shown by the dotted line will be connected to the No. 6 contact of the "B" relay of the called telephone relay set.

As soon as wiper P2 hits contact No. 08, negative battery will flow back through the 250 ohm resistance, over wiper P2, through normal contacts (8 and 9 of "D"), through the 250 ohm winding of "D" through make contacts (4 and 5 of C) to ground at the busy test induction coil. Enough current passes through the 250 ohm winding of "D" to close contacts 1 and 3 of relay "D." This is by the way a make before break spring assembly. Now battery flows from the rotary magnet through the make contacts (1 and 2 of B), through make contacts (1 and 3 of D), through the 500 ohm winding of relay "D" to ground at wiper P1 which being off normal is grounded. Now the direction of the current flow through the two windings of the relay "D" must be in the same direction so that both coils will set up a field in the same direction. This brings the magnet of relay "D" to full strength. If one winding was reversed it would oppose the pull of the other winding. But both windings pull together and operate the armature of relay "D."

Relay D.

Relay "D" can be called the cut through relay. It performs the following duties:

1. Cuts through negative wiper through contacts (1 and 2 of C) and completes the talking circuit through the 2 M. F. condenser.

2. Cuts through positive wiper over positive line to telephone.

3. Grounds the private normal, or the P2 contact of line 05 through the make contacts of relay "B" (4-5).

4. Cuts through wiper P2.

5. Opens the rotary magnet circuit to relay "A" so that no further impulses can be sent from the calling device.

6. Prepares the circuit for the buzzer action of the rotary magnet when releasing.

7. Cuts off the busy at contact (8 and 9 relay D) so that no tone is heard during conversation.

When the calling subscriber completes

the call, and no busy test is received, then he presses the push button to ring. The push button has a make before break contact arrangement, so that the line is not opened when the springs are pressed. This places a ground on the negative line and opens up the positive line and allows the "C" relay to drop out. When "C" releases, it completes the ringing circuit from generator through make contacts (4 and 5 of A), through normal contacts (2 and 3 of C), through make contacts (5 and 6 of D) over the positive line of the called line to the ringer at the called telephone connected through its hook switch in normal position. There will also be a path for the ringing current through the winding of the "C" relay causing it to operate with the ringing current. Since all the other relays of the called line are in a normal position the operation of the called "C" relay does not cause any other operation. The resistance of the relay "C" and the ringer of the called telephone would naturally be about the same.

When the wipers are in rotation, only wiper P1 is connected, the others are all dead. This prevents any disturbance on the other lines as the wiper passes over them. The wiper tips must of course not touch two adjacent contacts at the same time else these two lines would be crossed.

Talking Position.

A simplified circuit showing the actual talking position of two lines while connected. It will be noted that we have quite a common arrangement, with 4 impedances supplying battery for talking, with the two lines connected with a 2

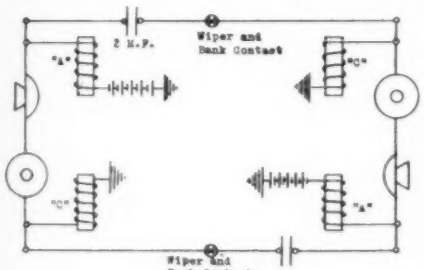


Fig. 248

M. F. condenser in each side of the circuit. This is similar to a condenser coupled common battery cord circuit.

For a better understanding of the circuits shown, the student is advised to try and draw the circuit. Commence with the "A" and "B" impulse relay set, as these will be found in practically every type of switch to be studied.

Sparking.

Sparking caused by the heavy current flow in the rotary magnet is prevented by the use of ½ M. F. condenser connected to ground or positive battery.

In 1880 there were 2,100 Bell telephones in service in Canada. Now there are more than 725,000.

Tri-State Telephone & Telepraph Company Sold to Theodore Gary & Company

Transfer of a majority of the common stock of the Tri-State Telephone & Telegraph company of St. Paul, Minn., together with the Dakota Central Telephone company and other properties of the Tri-State group, to Theodore Gary & Company of Kansas City, was announced during July. Some 165,000 stations are represented in this transfer, and puts the Theodore Gary organization second only to the American Telephone & Telegraph company in size and importance. It is understood that the purchase of these properties represents a sum above $20,000,000.00

The Tri-State Telephone & Telegraph company is one of the largest Independent organizations in the industry and its management under the guidance of Geo. W. Robinson has put it in the front ranks of successful telephone properties.

Theodore Gary & Company has been operating telephone properties for many years, and has acquired large holdings throughout the United States, Canada and other countries. They own a majority of the telephones in the Province of British Columbia, among their properties there is the British Columbia Telephone company. Other holdings are in South America and other parts of the world.

The Gary interests are large manufacturers of telephone equipment, among these the Automatic Electric company and the American Electric company, both of Chicago, besides factories in European countries.

Wright Metal, Inc., Lands Half-Million Dollar Contract

Wright Metal, Inc., of Jamestown, N. Y., of whom John H. Wright is president, recently secured the largest order for metal partitions ever placed for a single building. Last year Mr. Wright, who is also president of the Jamestown Telephone Corporation, organized the Wright Metal, Inc., for the manufacture and sale of adjustable metal partitions for office buildings, factories and stores, and his hundreds of friends throughout the telephone industry will be interested to learn of the manner in which the new concern is being put over.

The following news item from New York city tells the story:

New York.—The contract for the office metal partitions in the Lincoln Building now under construction at Forty-second Street and Madison Avenue was awarded today to Wright Metal Inc. of Jamestown. The Lincoln Building contract is regarded by manufacturers as the largest single order for high-grade metal partitions ever awarded in the history of modern office building construction. Wright Metal Inc. will install all of the partitions in the entire building, a final total of several miles, at a total cost of upward of a half million dollars.

At the offices of Wright Metal Inc., in this city it was stated yesterday that the Lincoln Building award to the local company brought to a close a competition of several months which was participated in by practically every metal partition manufacturer in the United States. The company feels that its success in being chosen for the work was due entirely to the complete interchangeability of its partition and to the superior workmanship shown in the construction of the typical office partition that was set up in New York for examination by the Lincoln Building owners. The local company also feels that its success is a signal victory for Jamestown's metal manufacturing plants.

The Lincoln Building is a 53-story office building towering 678 feet above the street and extending from Forty-second to Forty-first streets. Its 53 floors will require thirty elevators.

The Wright Company, in connection with the Lincoln Building award, also secured the contract for all of the metal partitions for the new Columbia Broadcasting Building at Fifty-second Street and Madison Avenue. The Columbia Building is of eighteen stories, approximately 250 by 150 feet. It is to house the Columbia broadcasting studios and offices and other tenants.

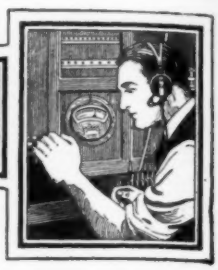
In addition to these two New York City awards the Wright company has recently been awarded the contracts for two large installations in Glens Falls and Elmira. The Glens Falls Insurance Company is doubling the size of its present office building and the entire building will have Wright interchangeable partitions. The initial order is for $20,000.

In Elmira the Wright company is installing both metal partitions and metal doors throughout the entire office building of the Eclipse Machine Company, one of the many General Motors plants.

The city of London now has 138 telephone exchanges, as compared to 120 a year ago.

The opening of an aerial telephone line between Roumania and Hungary provides the first telephone service between those countries since the World War.

LINE AND DESK



HAVING EXTRA FUSES HANDY.

When one of the fuses on the power switchboard feeding the relay rack, switchboard or other main circuit of an exchange is blown, every minute saved in replacing it counts. A man does not want to spend several minutes looking through a locker to find the fuses and to get one of the right size. In an exchange where I worked recently, I saw an idea that seemed to be the most convenient scheme for having fuses ready when they are needed. A number of extra fuse clips were obtained and mounted on a board which was mounted on the wall within reach of the power board. Two fuses of each size used were placed in the proper clips. The board was stencilled "Extra Fuses" and the proper ampere capacity was stencilled under each fuse clip. When a fuse blows, one is taken from the clips and is put in place of the blown fuse. The blown fuse is then disposed of and a new fuse is placed in the clips on the board of rextra fuses to be ready when it is needed next. Contributed by C. A. Foster.

A USE FOR OLD INDUCTION COILS.

In placing an order for some telephone material sometime ago I asked the salesman if his company carried small gauge bare tinned wire that could be used to wrap and hold together the tinsel of switchboard cords. He stated that he thought his company carried such a wire but suggested that I use instead the wire off of a defective induction coil.

I gave the matter little more thought until today when I was examining a coil which had a "short" between the primary and secondary windings. It was then noticed that the wire was just the thing I had been wanting, being a tinned wire of the proper size which only needed to have the insulation slipped off.

Possibly a lot of fellows in the plant end of the game have known this a long time and then there may be some who do not need any bare tinned wire of that size; but if they do my advise is to stop throwing away these old defective coils and start using the bared wire for any purpose for which it may be needed.

Contributed by Ernest Womack.

SOME TROPICAL TELEPHONE EXPERIENCES.

Major General Charles McK. Saltzman, retired, former Chief Signal Officer of the U. S. Army and, at present, a member of the Radio Commission, gave an interesting talk on his army telephone work at Pioneers' meeting at the Willard Hotel, in Washington, according to the Transmitter, the employers' magazine of the Chesapeake & Potomac Telephone Co.

About a year after the Philippine Islands became a U. S. possession, an insurrection of natives took place. Prior to this insurrection the Army Signal Corps had built a telephone and telegraph system throughout the islands and had laid submarine cables connecting several of the larger islands.

It was a difficult and dangerous undertaking to build and maintain lines in that country, especially in the southern group of islands where the Moros and other people of the Malay type live. The Moros never lost an opportunity of cutting down a couple of miles of copper wire and carrying it away for their personal use.

It was soon learned that the telephone system had other enemies. The poles were of hard wood cut from the natural forests. While apparently sound, these poles would fall down, and investigation showed that white ants had worked from the core and reduced the insides of the poles to powder within a year from the time they were set.

Obviously something had to be done. Tropical country was new to American engineers. General Saltzman was sent to the island of Borneo to consult British Army engineers. His account of the interview is amusing. He explained what that subtle enemy, the white ant, had done to the poles in the Philippines, and the Britisher replied, "Oh, really!" Encouraged by this eloquent interest General Saltzman then inquired, "Do you have similar enemies affecting your telephone system?"

"Oh, rather! Elephants."

The British officer then enlarged on his statement, telling how the elephants emerged from the jungle and amused themselves by breaking down half a hile or so of poles, using them as scratching posts. As a remedy the engineers had spikes driven in each pole, but that made them even more desirable for scratching.

General Saltzman then described a cable break between two important islands of the southern group in the Philippines. The Government cable boat was far away in Alaska, and only a small gunboat was available. This was loaded with material and started down the coast with mechanics, the boat's crew and two armed soldiers.

Charts guided General Saltzman and his command into the bay across which the cable was laid. On the south shore of the bay the cable ran up a river on the shore of which a cable hut had been built. The rivers, ten in number, emptying into the bay were not charted. Nothing remained but to explore each river until the cable hut was located. A native guide, who accompanied the party, thought he would recognize the appearance of the river when they came to it. The boat could not approach the river mouth he designated because of silt obstructions and sand bars. They anchored five miles off shore, loaded a small boat with necessary cable supplies and rowed under the blazing tropical sun far neough up the river for the guide to decide it was the wrong river.

A second river was explored with the same result. The third river was ascended and the cable hut seen upon its bank; also 11 large, husky Moros were counted, peeking out from behind trees, each man armed with a long war knife. The two soldiers and two other armed men could have "cleaned them out" in short order if the need arose, but the small party of whites knew there were thousands more of the natives hidden away in the jungle and were thankful no exchanges of that sort of courtesy became necessary.

They got to work as early as possible and General Saltzman's tests showed the trouble to be about three miles out from the hut. Still using the small boat crowded with men and supplies, they finally succeeded in hooking up the cable, cutting and making tests which showed an apparent miscalculation of about a mile. A resplice was made and the real source of trouble sought; again the cable was opened and tested only to find the trouble showed a mile back. The cable was respliced and dropped overboard. They rowed back, the sun getting hotter and hotter. They hauled the cable up again and much to his disway General Saltzman's test showed the

Ramblings

By J. A. S.

Time, please? What'd mean, time? Where, when and why? Time of day is a puzzle these days of rapid fire business. This subject was discussed at Wawasee recently at the convention of the Northern Indiana Telephone convention. "It's hard to get a party on long distance these days," says Walter Uhl. "Over in Chicago it's nine o'clock, while here in Logansport it's eight o'clock; then over in Ohio, Eastern Standard time is nine, while in New York City it is ten." Continuing, Walter said: "At ten o'clock here in Logansport—just when the business day begins—it is noon in New York, and we cannot get a party because he has gone to lunch. At noon we go to lunch and when we return to the office and renew our call to New York it is around four o'clock and the party has gone for the day." So what are you to do? Too darn many different clocks voted the crowd. Any way you look at it, it's a problem we can't solve.

* * *

Over at Manchester, Ind., the telephone subscribers are up in arms because the Northern Indiana Telephone Co. asks a two-bit raise in rates. A large number of subscribers have discontinued service and protest meetings are being held; threats are made of organizing a mutual company to furnish service. Experience teaches that mutual concerns furnish service below cost for a few years, the lines deteriorate, and the original investment is lost—but the neighbors have had their revenge. Still, we do not hear of anybody storing his car when the price of gasoline is boosted by John D.

* * *

January 1st of this year the United States operated over 60 per cent of the telephones of the world. Of the approximately 31,000,000 phones in existence, 18,500,000 were within the bounds of this good old country. An average of about one in each seven has a telephone. Perhaps 90 per cent of these phones were manufactured in half a dozen factories. Some job, we calls it!

* * *

Court battle still rages over a division of the income from slot phones in Chicago, where the state commission only allows a nickel charge. Many of the hotels and drug stores refused the new contract offered them, claiming that the new contract reduced their income to where phone booths were not profitable in the high rent section. This the telephone company denies. Seems to be a case of where "the devil said yes but the Lord said no." Here's hoping that right prevails.

* * *

John W. Glenn, pioneer telephone man from Bluffdale, Texas, died at his home recently. Mr. Glenn never attained unusual heights in the financial world; he was content to work in his own home town and with his neighbors, consequently there was no real possibility for expansion. But those who knew him can vouch for the height to which he attained as a good citizen and progressive business man in the little town in which he lived. Sometimes whole nations tremble when a financier dies, but when such men as John Glenn die, real hearts tremble.

* * *

Charles A. Rolfe, of Redlands, Calif., and president of the California Independent Telephone Association, recently resigned as president and director of the Southwestern Home Telephone Co. Mr. Rolfe was former owner of this property but last year it passed into the hands of the Western Utilities Corp. of San Francisco. Rolfe pioneered the Independent telephone business in the far west and accumulated considerable property in so doing. Here's hoping that he lives many years to enjoy the fruits of his labor.

* * *

Oklahoma and Texas are pulling their annual district meetings down in the Southwest and are meeting with the usual good efforts that have been their's for some time. These organizations work long and hard to make it hot for the anti-Independent manufacturers of that section in order that the pro-Independent concerns get the cream. We trust these manufacturers will find it in their hearts to co-operate more fully with the associations and their official publication in that section.

* * *

B. Y. Chambers, former manager of the Ohio Central Telephone Corp. at Mt. Gilead, Ohio, is now holding a similar job with the Southern Indiana Telephone & Telegraph Co. at Madison, Ind. Mr. Chambers has percolated through several states since leaving the old job at Dallas, Texas; later he was located in Kentucky, Georgia, and God knows where else. During his ramblings he has gathered considerable experience, and now we find him one of the best managers in the country. Roving stones gather valuable information.

* * *

H. F. McCulla, assistant commercial superintendent of the Lincoln Telephone & Telegraph Co., Lincoln, Neb., was recently signally honored by the United States Junior Chamber of Commerce. McCulla was unanimously chosen president of that very thrifty organization.

Vacations are becoming easier as time goes on, and it is possible to reduce the high cost of rents, too, if the plan works out. W. S. Rice, formerly of Orleans, Ind., rigged out a "house on wheels" recently and, together with his family, started on a trip west, perambulating here and there, visiting relatives and friends, as well as seeing the country. Rice was formerly with the Southern Indiana Telephone & Telegraph Co. "I'll get by," he says, talking to his Ford, "as long as I have you."

* * *

We thought only men slept in churches but reports have it that an Illinois telephone operator succumbed to the wooing of summer and fell asleep in church. She was awakened by the minister announcing Hymn 711 and quickly said, "Hold the wire, I will ring them again."

* * *

Our old friend, A. C. Stuart, president of the Two States Telephone company with headquarters at Texarkana, Texas-Arkansas, joined A. B. Elias, vice president of the Southwestern Bell Telephone company of St. Louis, on July 6th for an automobile trip through Wisconsin. We presume this is to be a pleasure trip as we do not know of any business this Texan and former Texan have in that section of the country. But we'll say they are using good judgment in taking the trip at this time, when thermometers are exploding in the South like bombs in Chicago. The only bad feature of these two-week vacations in the cooler sections is the return trip when the hens are laying boiled eggs at home.

Some Typical Telephone Experiences

(*Continued from page 30.*)

trouble a mile away in the direction they had just left. Aside from the labor and discomfort, the General was feeling decidedly foolish. He knew his calculations were correct, according to the findings of the testing apparatus, yet three failures were all they had to show in their efforts to clear the trouble.

One sure way of finding the break was to under-run the cable. They returned to the ship and came out againt with a second small boat and after great difficulties succeeded in raising and stretching the cable across these two boats. They discovered what had baffled and puzzled them all morning. The distance between the two points where General Saltzman had made his tests was about one mile. But the cable length between these points was nearly three miles. Evidently, the men who originally laid the cable had some surplus to dispose of and this seemed a good place to let it rest.

Never Quiet

"Is your sister still in Atlanta?"

"Say, that girl ain't still anywhere."

Means and Methods of Circuit Coupling

Mr. F. J. Dommerque Has Contributed Many Articles for Telephone Engineer in the Past. The Following Article Contains Much Information of Interest

Orientation

All circuits offer a resistance to the flow of current. If the current is a continuous current the resistance offered is an ohmic resistance. If the current is alternating, the resistance is increased. The total opposition to the alternating current in the circuit is then called "impedance," this impedance being the geometrical or vector sum of the ohmic resistance of the circuit and the "reactance." The reactance is due to the influence of inductance or capacity or both in the circuit.

The resistance or impedance, as the case may be, therefore obstructs the flow of current by placing an obstacle in its path. The obstacle in the circuit to the flow of continuous current may be compared to the friction between the walls of a pipe and the water flowing in it. The pressure behind the water which makes it flow is comparable to the e.m.f. applied to the circuit. A still better simile than the pipe would be a disk or wheel rotating in a vessel filled with water and thereby undergoing a friction which represents the resistance offered.

In a circuit containing an impedance this simile would not hold true. The alternating current changes all the time. The more rapid it changes the greater the e.m.f. in the circuit and consequently the greater the inductive reactance. In a circuit containing a condenser, the reactance is less, the more rapidly the current varies, because the greater the number of charges and discharges of the condenser in each second the greater the current.

The inductive impedance may be illustrated by the mechanical example of a fly wheel possessing a moment of inertia. Its rotation is instigated by the turning moment and finds a counteraction or resistive force depending on the angular velocity of the fly wheel. The moment of inertia is the inductance L in the electric circuit and the angular velocity the current.

The capacitive impedance is comparable to the resistive effect of two spiral springs holding a wheel carried upon a shaft in position, each spring being attached to the wheel on one side with its one end fixed to the ground with the other end. When the shaft is turned it cannot revolve completely but moves to and fro as far as the extension of the springs will permit. The ability of the spring to extend corresponds to the capacity C, the extension itself corresponds to the quantity of electricity.

In the following diagrams of coupled circuits the resistances marked R_1 and R_2 of the coupled circuits designate the ohmic resistance in case of continuous current flow and continuous e.m.f., or the impedance in case of alternating current and e.m.f.

Definition of Coupling

Two circuits may be linked together in a number of ways. A well known example of linking two circuits is by means of the listening and ringing key, where on the one hand the operator's telephone circuit is connected to the line, and on the other hand, when the key is thrown over, the ringing circuit is connected to the line. This linking together in the one case of the operator's telephone circuit and line and in the other case of ringing circuit and line is not what is technically known as coupling of circuits, it is simply a "switching" process. The switching is done by hand and the instrument or switch employed is the listening and ringing key.

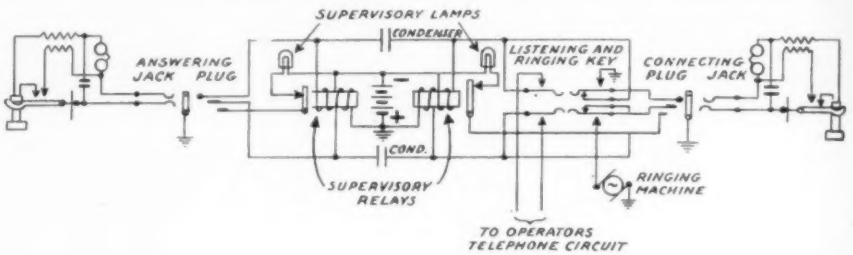


Fig. 1

Two circuits may be linked together by a relay. In that case no hand operation comes into play. The linking action is performed by making a contact by means of an electrically operated device; the action, however, of joining the two circuits is a mechanical process. This kind of linking two circuits may be, and is, designated as "mechanical coupling."

Another way of linking two circuits is by means of a resistance or an inductance coil or a condenser. If the two circuits are linked together by means of a resistance, the action is called a "coupling" and in this particular case a "resistance coupling." If the two circuits are linked by means of an inductance coil the action is designated by "inductive coupling," and if the two circuits are linked by a condenser, it is said to be a "capacitive coupling."

The above definitions of coupling methods are the most general. But there are different combinations in different forms and fields of application, which have been given distinctive names. Even the three couplings mentioned above are frequently designated by other names, namely the resistance coupling as "galvanic coupling," the inductive coupling as "magnetic coupling" and the capacitive coupling as "dielectric coupling." Very often one finds in technical dissertation the designation "electric" coupling in place of dielectric coupling, which is liable to be misleading and is not desirable in any case as "electric" is too general a designation.

Graphical Exposition of Coupled Circuits

Since telephony has expanded so largely in late years and more so, since radio engineering has appeared as a new science, the coupling of circuits has become an important subject. We, of course, had circuit coupling ever since telephones were in use, but nobody classified them as such, because in the first place there were too few who had to deal with the theoretical end of the telephone work and in the second place there was no real need for a classification of this kind. But today where radio has brought even the amateurs to the study of the theory of electricity and electric phenomena, and where more researching is done than ever before, the subject of

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This outlay is required because the telephone is a universal servant of this democracy. Business uses it to create more prosperity. Homes use it for comfort and protection, for keeping friendships alive and enriching life. Its general use enables each personality to extend itself without regard to distance.

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circuit coupling has taken a prominent position in the field of investigation and one has to reorganize this position when dealing with communication circuits.

To come to our problem, the circuit shown in Fig. 1 is presented to illustrate the difference between linking circuits

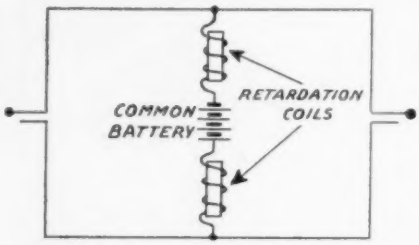


Fig. 2

by "switching" by "mechanical coupling" and by "electrical coupling," the latter designating collectively the galvanic or resistance coupling, magnetic or inductive coupling and dielectric or capacitive coupling.

The reader will recognize in this figure the figure 3 of the talking circuit shown in the March number of the TELEPHONE ENGINEER, only in the present drawing we have somewhat enlarged upon the previous circuit. This figure shows a listening and ringing key. The operator's telephone circuit is not detailed as being immaterial to the purpose of our illustration. This listening and ringing key performs the "switching" as stated before. The plugs and jacks in this circuit are also means of switching, in the present case they join the parts of the talking circuit together, but there is no coupling of circuits involved.

This figure represents the major part

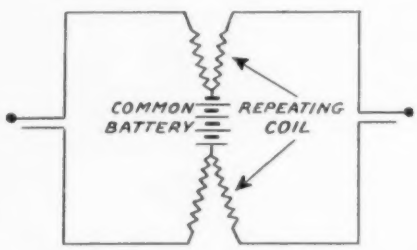


Fig. 3

of a common battery subscriber's circuit. The common battery is in the center. On each side of the battery are shown two relays, the so-called supervisory relays. These relays are normally in the position shown in the drawing, as all circuits as a rule are shown with their apparatus in normal position, only when a particular point of operation is to be explained, is the apparatus shown in some particular act of operation. To energize these relays, that is, to close the battery circuit through the relays, the plugs have first to be placed into the jacks. Suppose a subscriber (the one shown at the left side in Fig. 1) has made a call by taking his receiver off the hook. This line lamp will light in front of the operator at the switchboard position where his line terminates. This line lamp with its associated relays is not shown in the drawing so as not to bring in complications. The operator on seeing this signal places the answering plug into the answering jack to which the calling line is connected, thereby establishing a path for the flow of current from the negative side of the battery through the one winding of the supervisory relay on the answering side, over the tip of the plug which rests upon the tip spring of the answering jack, over the one side of the line to the calling subscriber's telephone, through the secondary winding of the induction coil, over the contact on the hookswitch which is now closed, over the hookswitch through the transmitter, back over the other side of the line, over the ring spring of the answering jack and ring

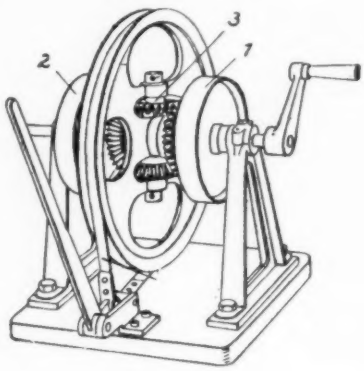


Fig. 4

of plug, through the other winding of the answering supervisory relay to the positive side of the battery. The supervisory relay will be energized and attract its armature; this, however, will have no effect. Suppose now the operator had received the order and wanted to connect to the desired subscriber's line. In that case the desired subscriber would have his telephone still on the hook and the contact on the switchhook would be open, therefore there would be no flow of battery current through the supervisory relay on the connecting side, but the supervisory lamp would be in a circuit from the negative pole of the battery over the armature of the connecting supervisory relay, over the third contact or the sleeve of the connecting plug and jack to ground, and would light and stay lighted until the desired subscriber would answer the call and take his receiver off the hook, when the contact on the switchhook would be closed and the same circuit condition would be established through the connecting supervisory relay as before described through the answering supervisory relay with the only difference that the two sides of the line pass this time over the springs of the ringing key.

The above circuit description shows the action of the supervisory relays in opening and closing the supervisory lamp circuits. The relay action is instigated by electromagnetic influence, but the action of opening the lamp circuit by attraction of the armature is a purely mechanical performance, whence we have to deal here with a "mechanical" coupling, the action being mechanical but the force behind the action being electrical, in fact here two electric circuits are coupled mechanically.

The supervisory relays in this circuit besides their mechanical coupling function have still another function to perform, namely to act as retardation coils to choke off the voice currents. They will not let the voice currents pass through, but force same to take the much easier path for alternating currents over the condensers. They are transmitted from one side of the talking circuit to the other side by the action of dielectric displacement, thus we have here a "dielectric" coupling. In the circuit shown in Fig. 2 the common battery furnishes current to the line both ways. The current flows to the line over two retardation coils, but the two circuits are linked directly without the intervention of a condenser or a repeating coil, therefore we have here a "galvanic or resistance" coupling.

In Fig. 3 many will recognize the skeleton of the familiar Western Electric common battery A-operator's cord circuit. Here the common battery is fed to the talking circuits of the subscribers through the windings of a repeating coil or transformer, the battery being con-

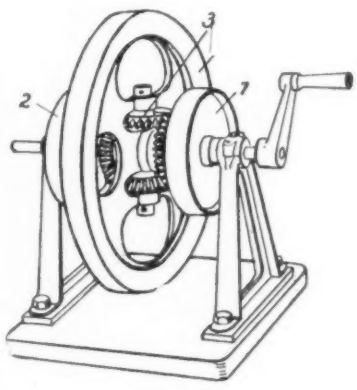
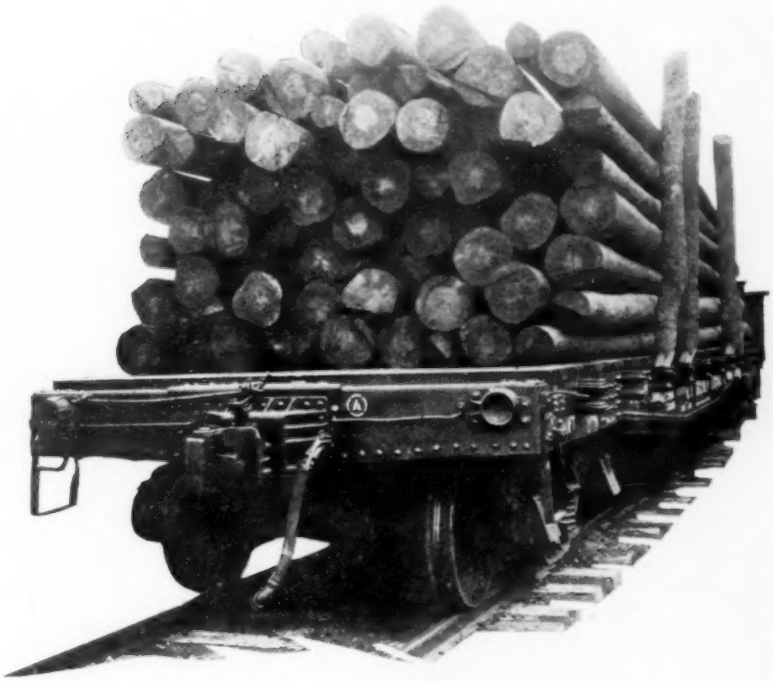


Fig. 5

nected at the center. The linking of the circuits is effected by means of this repeating coil, thus we have here a "magnetic or inductive" coupling.

To still further illustrate the three kinds of electric coupling by a mechanical model, which was used by Dr. R. Franke for demonstration in his lectures, electric coupling is reproduced by means of a differential gear; the Fig. 4 illustrates a galvanic or resistance coupling, Fig. 5 a magnetic or inductive coupling and Fig. 6 a dielectric or capacitive coupling.



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In Fig. 4 the rotating gear wheel, 3, forms the coupling between the two other gear wheels 1 and 2. The gear wheel 3 can only transmit the motion from gear wheel 1 to gear wheel 2 when it is held permanently or temporarily by a counter force, otherwise the gear wheel 3 driven by gear wheel 1 would only roll upon gear wheel 2 without effecting a turning motion on it. This counter force

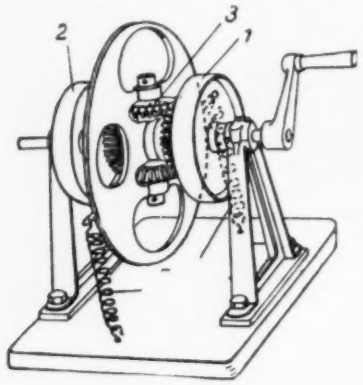


Fig. 6

can be friction or inertia or springs. In the combination shown in Fig. 4 it is friction applied to the rotating member 3 by means of a band brake. The thereby effected friction coupling corresponds to the "galvanic or resistance" coupling. In the combination of Fig. 5 the gear wheel 3 is formed into a flywheel and thus possesses the moment of inertia of a swinging mass, thus corresponding to a "magnetic or inductive" coupling. And finally in the combination of Fig. 6 the gear wheel 3 is held by a spring on each side in a normal position, but is able to

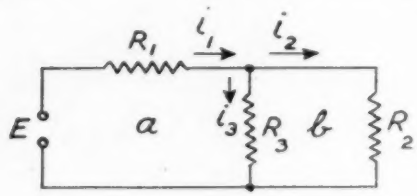


Fig. 7

move either way; no rotation can be effected, but a swinging or pendulum motion. This imitates the action of the "dielectric or capacitive" coupling.

In the galvanic coupling the potential difference between the two terminals of

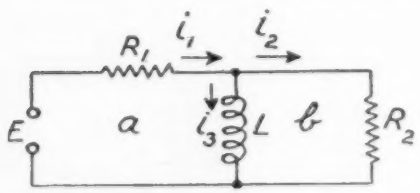


Fig. 8

an ohmic resistance effects the coupling. In the magnetic coupling the action taking place between the two circuits being coupled is due to magnetic lines of force and in the dielectric coupling to electric lines of force.

Direct and Indirect Coupling

In Fig. 7, 8 and 9 the three kinds of coupling are shown in their most simple form. The coupling member, a resistance R_3 in Fig. 7, an inductance L in Fig. 8 and a capacity C in Fig. 9, is in each case common to the coupled circuits, which consist of circuit "a" containing an e.m.f. E and a resistance R_1, and a circuit "b" containing a resistance R_2. This kind of coupling is designated as a "direct" coupling.

The coupling effect is the same for continuous and alternating currents. If the current flowing in the circuit "a" is designated by i_1, the current flowing in the circuit "b" by i_2 and the current flowing in the coupling member by i_3, the current i_3 will at any instant have the instantaneous value $i_3 = i_1 - i_2$.

More familiar is the "indirect" coupling, which is shown in Fig. 10, where two separate circuits are coupled by a member which consists of a mutual inductance. Therefore we have to deal here with an "indirect magnetic coupling." The two circuits are separated physically;

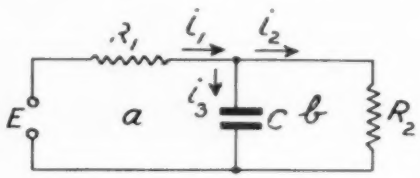


Fig. 9

they are, however, connected electrically by the magnetic flux Φ_1 generated by the current i_1 and the magnetic flux Φ_2 etc. current i_2. In this case the total magnetic flux is at any instant $\Phi_3 = \Phi_1 - \Phi_2$.

The arrangement shown in Fig. 11 is a transformer, which appears again and again in telephone work as repeating coil, hybrid coil, etc. It is the most known method of circuit coupling. We will briefly review the action taking place in coupling two circuits like the ones shown in the figure. Let the e.m.f. impressed across the terminals of the primary be an alternating voltage. Then

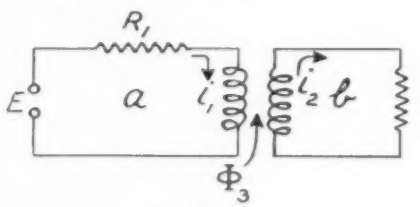


Fig. 10

the current in this primary coil will produce a magnetic flux; but not all this flux will thread the secondary, part of it will be dissipated as leakage. The part which threads the secondary induces an e.m.f in the secondary winding. This secondary voltage causes a current to flow in the secondary winding, the instantaneous direction of which is opposite to that of the current in the primary winding. Part of this secondary flux is opposed by the flux coming from the primary and in this way energy is transferred from primary to secondary coil.

The percentage of total primary flux

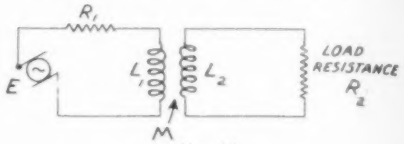


Fig. 11

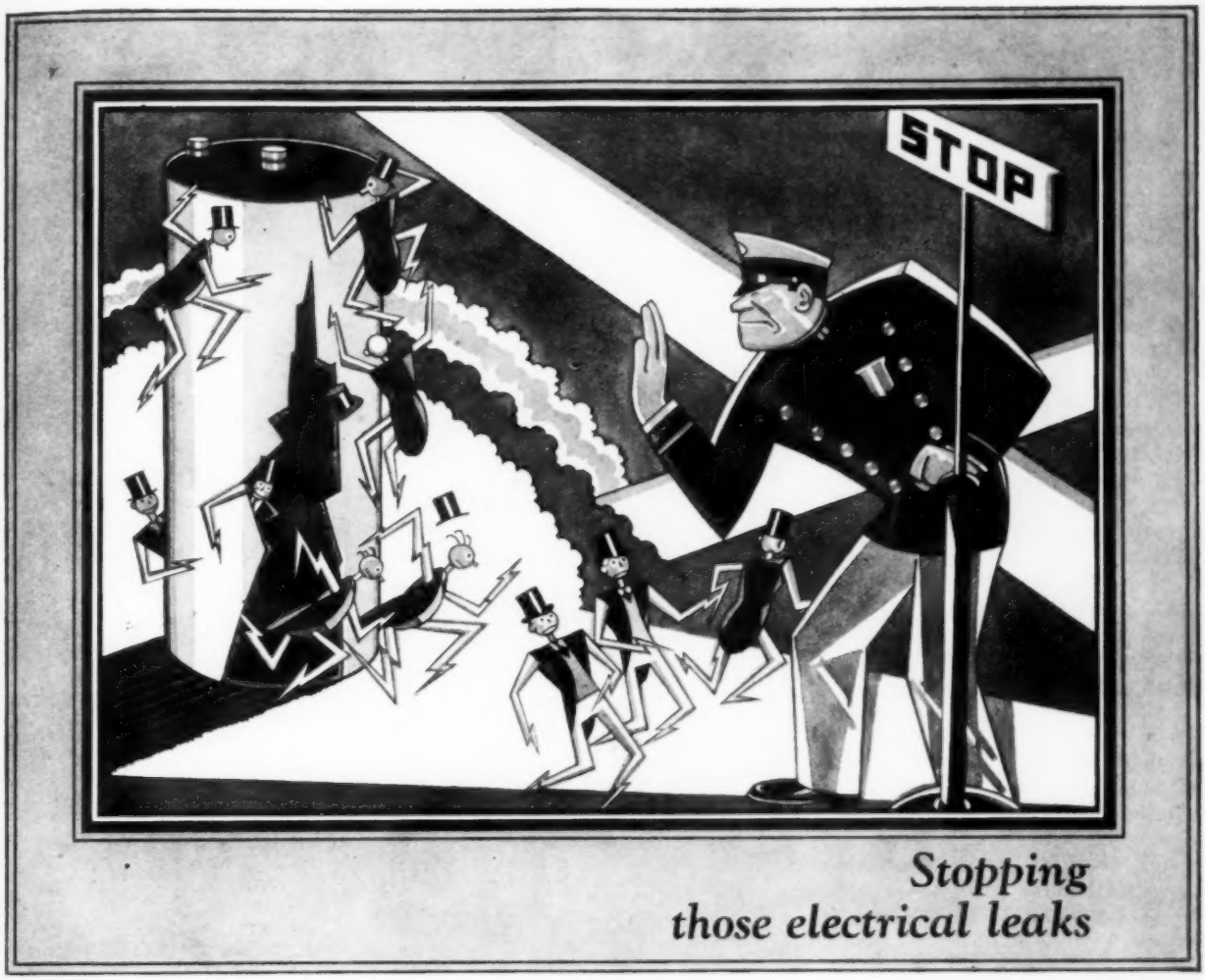
used in the transfer of energy from primary to secondary gives the coefficient of coupling "k." If the mutual inductance between the coupled circuits is M and the total self inductances in primary and secondary circuit are L_1 and L_2 respectively, the coefficient of coupling will be $k = \frac{M^2}{\sqrt{L_1 L_2}}$.

Oklahoma Utilities Association District Telephone Meetings

District telephone meetings were held at Beggs, July 16, Wynona, July 17 and Salina, July 19. The total attendance was 162. Sam Hand, Beggs, Chairman, Telephone Division, Oklahoma Utilities Association, presided. Telephone people who attended and addressed all of the meetings were: C. G. Gardner, Nacoma, Texas, Kellogg Switchboard & Supply Co.; R. D. McDuffie, Kansas City, Mo., American Electric Co.; J. E. Wilkins and Mrs. J. E. Wilkins, Oklahoma City, Stromberg-Carlson Tele. Mfg. Co.; B. L. Rasor, Oklahoma City, Transmission Engineer, M. A. Sanders, Oklahoma City, Connecting Company Agent, Southwestern Bell Tele. Co. and H. W. Hubenthal, Engineer, Oklahoma Utilities Association. W. L. Crittenden, Chairman, Speakers' Bureau, Oklahoma Utilities Association, talked on "Mexican Utilities." City and civic officials, local citizens and representatives of other utilities cooperated with the telephone people. Principal subjects discussed were: Rural Line Telephone Service, Construction Methods, Local and Long Distance Service and Practice, Public Relations, Ownership of Telephone Equipment, Collection of Antiquated Telephone Apparatus and Association Activities.

Heads Phone Group

Directors of the Indiana Telephone Association meeting July 7th at the Claypool Hotel, re-elected Henry Barnhart, Rochester, president of the association. R. V. Achatz, Aurora, was elected first vice-president; Samuel Tomlinson, Plymouth, second vice-president; W. H. Back, Indianapolis, secretary and treasurer.



Stopping those electrical leaks

DRY batteries store up electricity in the form of chemical energy. Columbia Gray Label Telephone Cell energy is released only when the telephone receiver is up. These batteries contain no impure elements that produce miniature internal circuits and waste energy within the battery. Columbia Gray Label Telephone Cells are made especially for telephone work and because of their construction waste less electrical energy through electrical leaks when idle. That's why Columbia Gray Label Telephone Cells retain their power longer. Thus increasing telephone dividends.

NATIONAL CARBON COMPANY, INC.
General Offices: New York
Branches: Chicago Kansas City New York San Francisco
Unit of Union Carbide UCC *and Carbon Corporation*

Columbia
Telephone Batteries
Best by test—they last longer

Additional Automatic Facilities for Newark, Ohio, Network

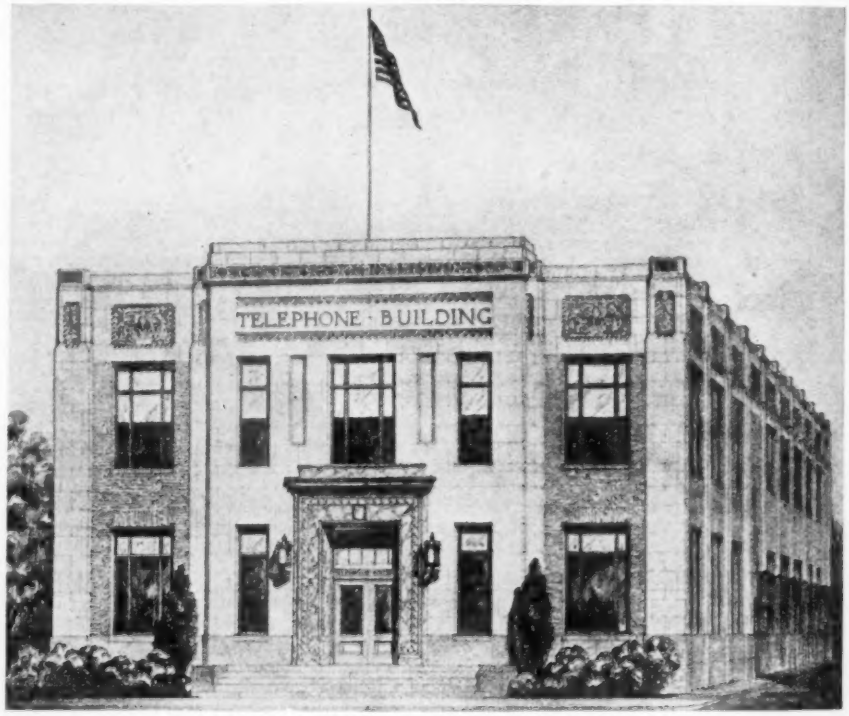
New Building Erected to House New Main Office, with Which Will Be Combined Former West and North Offices. 2600 Lines of Strowger Automatic Dial Equipment Added to Supplement Previous Installation, in Use Since 1911

Newark, Ohio, has had Strowger Automatic Dial telephone operation since 1911. The growth of the city has been such, and the increasing demand for telephone service has so increased, that the officials of the Newark Telephone Company ordered last year 2,600 lines of additional Strowger automatic dial equipment from Automatic Electric Inc., of Chicago. The completed plans included not only provisions for new and increased business, but also incorporated the retirement of certain of the old automatic equipment, and the combining of the former Main, West and North offices in one new Main office. The former West and North offices were operated as automatic sub-offices, but due to population changes and traffic requirements, it was found to now be economically sound to combine these units in one main exchange. The two former unattended automatic sub-offices at East and Granville will be retained as such, and will work into the new Main exchange.

The new telephone building in which the new Main office is located is a handsome and sturdy structure two stories in height. Cream colored brick and terra cotta are used, and steel beams give the construction unusual solidarity. Provisions are made so that another story can be added when telephone demands in the future justify such an addition. The architectural design of the building is in simple, straight lines with a pleasing front facade.

The first floor is given over to commercial and general offices. A garage and construction department are in the rear. The automatic switchroom is located on the second floor, which also contains the toll room, assembly room, rest room, kitchenette for the use of employes, and in the rear of this floor is a repair shop. The basement contains the battery room, gasoline engine charging set, fuel room and storage space for surplus material.

On July 3, 1929, the new Strowger automatic dial equipment, combined with certain of the former apparatus, was cut into operation at the new Main office. The West and North sub-offices were not included in this first step of conversion, but for the time being will be operated separately. Their load will be taken over by the new Main office and they will be discontinued as separate offices at a second cut-over to be made some time in September. The carrying out of this unification plan, and the adding of new and up-to-date equipment gives Newark an excellent operating network, and the Newark Telephone Company, of which W. L. Cary is president, is to be congratulated upon its completion of this extensive program which will give the citizens of Newark the most complete and modern telephone service that it is possible to obtain.



Handsome new building of the Newmark Telephone Company, of Newark, Ohio, in which will be housed the new Main Exchange

Installed in the one building for the new Main office are 2,600 lines of Strowger automatic primary lineswitch equipment, of the self-aligning plunger type. To operate with this are six boards of rotary secondary lineswitches, six boards of selector equipment, and five boards of connector equipment. These boards are not at present fully equipped, but provide sufficient additional facilities, together with certain of the former equipment which is being used, to take care of the enlarged present telephone needs of Newark, with ample provision for future additions to supply adequate service for many years to come. Auxiliary new equipment which has been installed includes a new main distributing frame, a new trunk intermediate distributing frame, a traffic relay rack, and intercepting trunk-ringing equipment. The present equipment at Main office, when the unification is completed, will total approximately 3,500 lines. The total network, including the East and Granville offices, will supply telephone service to over 10,000 telephone users.

Automatic Electric Inc. has also furnished and installed for the Newark Telephone Company a new six-position toll and paystation board, which incorporates all of the newest features of

"STEWART" DIRECT READING TEST CABINET

The "STEWART" Direct Reading Test Cabinet reads the resistance to shorts, crosses and grounds direct in ohms on the scale of the meter. We furnish a mile card with cabinet that gives distance to trouble in all kinds of wire without figuring. Any man can install and use it. Price $56.00 for 15-volt scale. $61.00 for 150-volt scale. Sent on trial.

Also, lineman's Test Sets with detector coil, Cable Testers and Detecto-Meters.

STEWART BROTHERS, Ottawa, Ill.

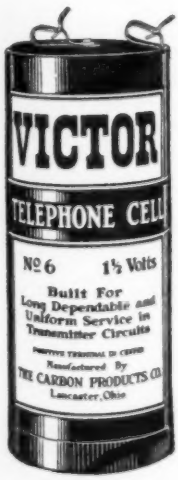
Note Protection at Corners

Blake Insulated Staples
Trade Mark

Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

Blake Signal & Mfg. Co.
BOSTON, MASS.

VICTOR TELEPHONE CELLS



The standard cell of the independent telephone industry. Uniform in quality. Dependable in service.

The Carbon Products Co
LANCASTER, OHIO
11 South La Salle Street, Chicago

WHAT'S one more gale to *Copperweld Insulated Drop Wire!*

Where real staying power is needed—resistance to storms, snow, heat, moisture, high winds—Copperweld more than fills the bill.

This twisted pair insulated drop wire is doubly fortified against *all* that the elements can offer.

Stronger than either copper or steel alone, and quality insulated and weatherproofed to Graybar specifications, no wonder Copperweld stands the gaff!

What's one more gale—to Copperweld!

GraybaR
Successor to *Western Electric* Supply Dept

Distributed by GraybaR

THE GRAYBAR TAG—SYMBOL OF DISTRIBUTION

operation, including C. L. R. operation. Other supplementary equipment which has been supplied for this installation are a two-position information and chief operator's desk and a two-position test and complaint desk. These boards were also cut into operation on the night of July 3, 1929.

A new gasoline engine generator set was supplied to augment the power supply, and this will operate in conjunction with the two rectifiers which are retained from the former installation. This new gasoline engine generator set has a capacity of 60 amperes at 50 volts. A new storage battery has also been installed, which, together with necessary new additions to the power board and supervisory and control equipment, provides the new Main office with power facilities ample for considerable future expansion in the switching equipment.

Testing Telepathy by Means of a "Ghost Hour" Over the Radio

The possibility of thought projection by electrical means was almost conclusively proved by radio when Dunninger, the psychologist, announced that more than 55 per cent of the 2,000 listeners who replied to his recent "Ghost Hour" test over an NBC network had accurately received at least one of the three thought projections which opened the psychic broadcast series. "It is extremely significant," Dunninger declares, "that it was by the aid of radio that the new record was established. No one is positive by what means radio waves reach the listener, and perhaps in its rays will be found a clue to the understanding of telepathy. Out of more than 2,000 letters sent in from radio listeners over 55 per cent were accurate in at least one of the three thoughts I tried to project. Of these more than 40 per cent clearly received the thought of Abraham Lincoln as an American President; considerably less saw 397 as the proper 'number of three digits,' but an amazing number clearly saw the 'geometrical figure' I intended—a small house with four windows and one door, with crude chimney and simple triangular roof. Many even had an intuition that ideas No. 1 and No. 3 were connected; they associated the thought of President Lincoln with a rude log cabin. Others said they could not draw, but described the house perfectly. The answers on No. 2, the 'number of three digits,' were surprisingly good. Over 40 per cent had two digits correct, and many other thought of 793 instead of 397. This is a common phenomena in telepathy, known as 'reverse mental reflection' which has given rise to the theory that in thought transference the mind is like a mirror. Only 2.5 per cent were completely accurate, but even this is unusual when 2,000 replies are considered as merely a cross-section of the potential audience. The nature of the replies indicates that most of the interest in the telepathy tests was centered among more highly educated people. Professional men predominate among those who replied; physicians and engineers head the list, while technical minds showed evidence of the sharpest interest."—Telegraph & Telephone Age.

Passengers on Leviathan Soon to Be Able to Talk to Any Phone Ashore

Equipment is now being installed by the American Telephone and Telegraph Company on the flagship Leviathan, of the United States Lines, which will make possible telephone communication between passengers at sea and persons ashore in early September. A small structure which will serve as the radio telephone room has already been installed, and when the equipment is completed, a passenger may lift the receiver in his stateroom and be connected with any telephone ashore in the same manner as when ordering long-distance service at home. A directional wave separate from the wave length of the ship's own radio apparatus will be used by the ship-to-shore service and the desired number will be sent over this wave to a shore receiving station. The connection will then be made ashore as in ordinary service.—Telegraph and Telephone Age.

3 Firms Lose Suit on Talkie Patents

The second attempt of the Western Electric Company, Electrical Research Products, Inc., and the American Telephone and Telegraph Company to establish eight patents alleged to be involved in manufacture of competitive talking-picture equipment has been unsuccessful in Federal District Court, Manhattan, N. Y.

The previous suit of the same companies against the Pacent Reproducer Corporation and the Pacent Electric Company was dismissed on June 6 by Judge William Bondy on the ground the Western Electric Company and Electrical Research Products were not proper parties plaintiff in the action.

The dismissal by Judge Coleman was on the ground the Western Electric Company, Inc., and Electrical Research Products, Inc., as non-exclusive licensees, had not sufficient interest in the patents in question to bring suit. Such rights as they have under the patents were obtained through assignment by the parent company, the American Telephone and Telegraph Company, it was held.

A. T. U. Buys Large Phone, Utility Companies

The Associated Telephone Utilities Co., of which S. L. Odegard and J. F. O'Connell, Madison, Wis., are vice-presidents, has purchased the Standard Telephone Co., a Delaware corporation, and its three subsidiaries, the Standard Telephone Co. of Illinois; the Standard Telephone Co. of Texas, and the Interstate Utilities Co.

The Standard Telephone Co. of Illinois, with headquarters at Decatur, supplies telephone service to 82 Illinois towns and adjacent rural districts located in 17 important counties of the state. The population served is approximately 165,300. There are 23,507 stations comprising 22,130 owned stations and 1,377 switched stations.

The Standard Telephone Co. of Texas, with headquarters at Amarillo, operates 35 telephone exchanges with approximately 7,225 connected stations of which 5,486 are owned stations and 1,379 are switched stations. Telephone service is supplied to 36 towns and contiguous territory in northwestern Texas, and southwestern Oklahoma serving a population of approximately 115,000.

The Interstate Utilities Co. with headquarters at Spokane, Wash., serves an estimated population of 309,000 in northern Idaho, eastern Washington, and northwestern Montana. The company owns and operates 32 exchanges totalling in excess of 14,300 stations. Of this number 12,000 are owned stations while 2,362 are switched and leased.

The number of stations directly served by the three subsidiary companies is approximately 45,100; comprising about 39,975 owned stations and 5,118 switched and leased stations. Total population served exceeds 580,000.

Paul Schwerin in New Post

Paul Schwerin, formerly associated with the Western Electric Company and the Bell Telephone Company and holder of forty patents in connection with radio tubes, has been named director of research of the Perryman Electric Company, Inc. Mr. Schwerin is the inventor of the water-cooled anode tube which facilitates trans-oceanic telephony, and for which he has filed basic patents in every civilized country.

Telephone Association of Canada Convention

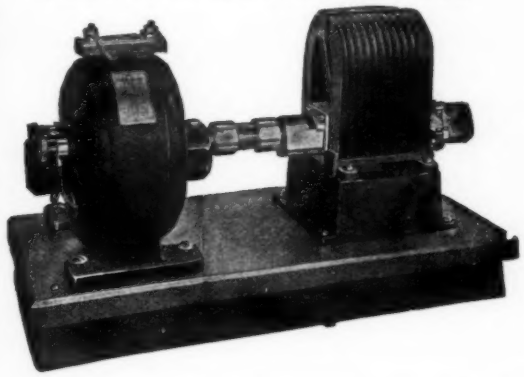
The annual convention of the Telephone Association of Canada will be held at Jasper Park, Alberta, from August 27 to August 30. The Alberta Government Telephones will be the host.

Toronto leads all Canadian cities in telephone service.

HOLTZER-CABOT

Magneto - Ringing - Motor - Generators

MAINTAIN BETTER SERVICE



Maintaining an efficient, economical, carefree ringing service need not be a problem—but it does require good judgment in selecting your equipment.

Install Holtzer-Cabot Magneto Ringing Motor Generators. These units will enable you to dispense with battery maintenance and constant service diligence. Can be supplied for any voltage or special current.

We invite correspondence. Complete data on request.

HOLTZER-CABOT ELECTRIC CO.

125 Amory Street, Boston, Mass.

6161 So. State Street, Chicago, Ill.

Get EVER-PROTECT aid in your construction.

EVER-PROTECT has proved practical and profitable in making many hundreds of cable installations underground without a conduit. It protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

Ask your nearest jobber for complete details.

EVER-PROTECT CABLE COMPOUND

TRADE MARK REG. U.S. PAT. OFF.

National Cable Compound Co.

Incorporated

MITCHELL - - IND.

Exide

BATTERIES

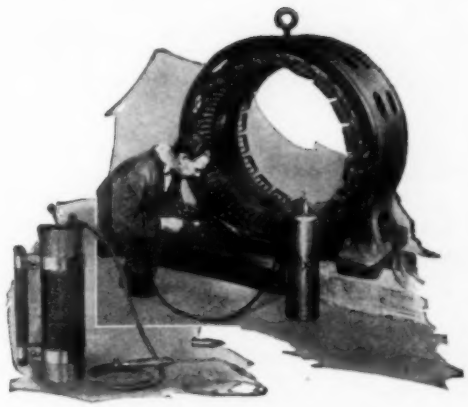
have faithfully served the Telephone Industry for the past 35 years.

This significant fact assures the same dependability for the future.

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA

Exide Batteries of Canada, Ltd., Toronto



Prest-O-Lite Is The Modern Blow-Torch

. . . Instantly ready, simply turn on the gas and light it . . . no lost motion . . . operates unfailingly and efficiently in any kind of weather, inside or out of doors . . . Moderate initial cost and economical—wastes no fuel between jobs—lasts indefinitely.

Prest-O-Lite torches fit every blow-torch need—do every heating, brazing or soldering job quicker, easier, better and at lower cost.

'Phone the Prest-O-Lite Gas Distributor about this equipment or write us direct for complete information.

Prest-O-Lite is available everywhere. Anyone of 15,000 Prest-O-Lite Exchange Stations can supply you quickly with a full tank.

Prest-O-Lite GAS

THE PREST-O-LITE COMPANY, Inc.

Unit of Union Carbide and Carbon Corporation

UCC

NEW YORK, N. Y.
Carbide and Carbon Building

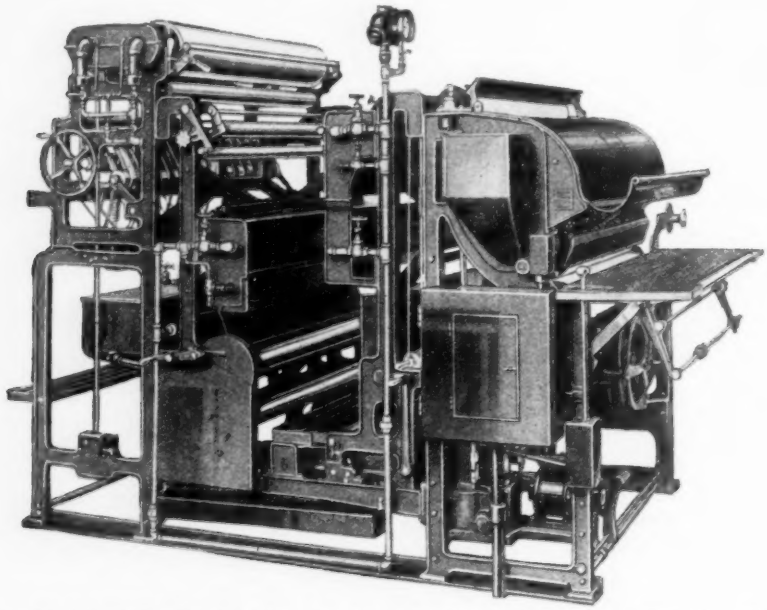
SAN FRANCISCO, CAL.
Adam Grant Building

IN CANADA: The Prest-O-Lite Company of Canada, Ltd., Toronto

New Blue-Printing Machine Makes Finished Prints at 12 Ft. Per Minute

Amazing speed of production, high quality prints, and low operating cost are outstanding features of the new Pease "Peerless" Model "30" Blue-Printing Equipment as announced by The C. F. Pease Company, 813 North Franklin Street, Chicago, Illinois.

This new "Peerless" Model "30" Continuous Blue-Printing Equipment is a marvel of engineering, revolutionary in design, and combines all the best mechanical features developed after long research in perfect blue-printing machinery. The Model "30" will produce excellent blue-prints, negative prints, and blue line and brown line prints and, while somewhat the same in operation as the present original Pease "Peerless" Model "20" Blue-Printing Machine, the new Model "30" as illustrated here differs radically as to design in many respects.



Pease Model "30" Blue-Printing Machine Produces Blue-Prints, Negative Prints, Blue Line and Brown Line Prints in Continuous Operation.

Following the usual practice, with this new machine tracings are laid face up on a continuous roll of paper, feeding at the front of the machine, and are carried upward around a semi-circular, uniformly curved segment of French plateglass, past a glowing bank of arc lamps. These lamps are individually mounted in horizontal alignment in front of the glass and give an intense light rich in actinic value, so valuable for reproduction purposes.

After the exposure has been made, tracings are automatically returned into the tray at the front of the machine near the operator's hands while the prints on the continuous roll of paper are carried through the machine and the subsequent operations of washing, potashing, and drying take place in succession. The paper is then automatically rolled up in loose cylindrical form at the rear of the machine for convenient cutting and trimming. All throughout this travel, the roll of paper is gear driven without drag or possibility of strain or breakage.

The new Model "30" Blue-Printing Machine is direct gear driven throughout, has a speed range of from 4 inches to 12 feet per minute and is powered with a variable speed ¼ H. P. motor direct connected to a fully enclosed gear reduction unit running in oil. At the extreme left hand side of the machine and mounted in the feed table is a special four-point auto-type gear shift providing for two forward speeds, high and low, also neutral and reverse. This reverse gear is an entirely new departure in blue-printing machine construction and on the Model "30" it permits the operator to withdraw tracings or run back the leader roll whenever desired, without inconvenience. At the right of the machine and mounted handily above the feed table is another speed control in the form of a hand-operated dial connected by sprocket chain to a rheostat located beneath the feeding table. This additional regulator permits instant change of printing speed to exactly the proper degree to conform accurately with the character of tracings being printed.

After exposure, as the prints are carried over the top roll of the printing machine, they pass down to a specially designed atomized water wash consisting of spray jets directing a pressure spray of water over the entire front and back surface of the paper. This method of washing insures thorough removal of all chemical and is much more effective than the ordinary flowing type of water wash used previously. After washing, the prints pass over in contact with a special 4-inch rubber covered roll set in a shallow pan at the bottom of the machine. This roll revolves in the same direction as the paper is traveling and thoroughly coats the entire surface of the prints with a uniform application of potash solution. Negative solution is applied by this same roll in the same manner and interchange of solutions is a simple matter of feed tank adjustment without danger of dilution.

After the developing process with either potash or negative solution, the prints are again washed in continuous operation, as previously described, by another spray jet arrangement. This gives them a final, thorough cleansing and the roll of paper is carried over to the final operation of drying.

The dryer of the new Model "30" consists of two chromium plated copper drums and an auxiliary air drying unit. These units are in graduated heat arrangement and because of the direct roll contact with the paper, prints are dried perfectly smooth and free from wrinkles. When especially thin paper is used, there is a special felt roller ironing attachment that insures perfect results. This device is attached to the rear roll of the machine and is adjustable so that it can be either raised or lowered into operating position as required.

While the new Pease "Peerless" Model "30" Continuous Blue-Printing Machine has a maximum production of 12 linear feet per minute and is particularly adapted to long run, high speed production, single prints can be handled equally as well and just as economically on this new machine. As a matter of fact, Model "30" Printer can be operated separately from the Washing and Drying Machine by means of a simple clutch adjustment and can also be purchased separately if desired. The Model "30" is made in two sizes, 42" and 54" widths, either 110 or 220 volts DC or 220 volts AC. The 42" machine is equipped with six lamps and the 54" machine is equipped with seven lamps. These lamps are of the special Type "P" enclosed arc style and consume either 6½ amperes on DC or 7½ amperes on AC when adjusted for their most effective printing speed.

Further information on the new Model "30" is contained in a special brochure and a copy of this booklet can be obtained without obligation upon request to The C. F. Pease Company, 813 North Franklin Street, Chicago, Illinois.

Crapo
GALVANIZED PRODUCTS

The pure zinc coating on *Crapo* Galvanized Telephone Wire and Strand is *non-peeling, non-cracking.* Even when subjected to splicing, twisting or bending, this protective coating remains uninjured.

That is why *Crapo* Galvanized Products are outlasting all others in actual service. That is why users, year after year, are reducing maintenance costs to new low levels....

Crapo Galvanized Telephone Wire and Strand can be obtained from representative Jobbers. Insist upon *Crapo* quality! You can identify it by the *Crapo* Tag....

Indiana Steel & Wire Co.,
Muncie, Indiana

TELERING

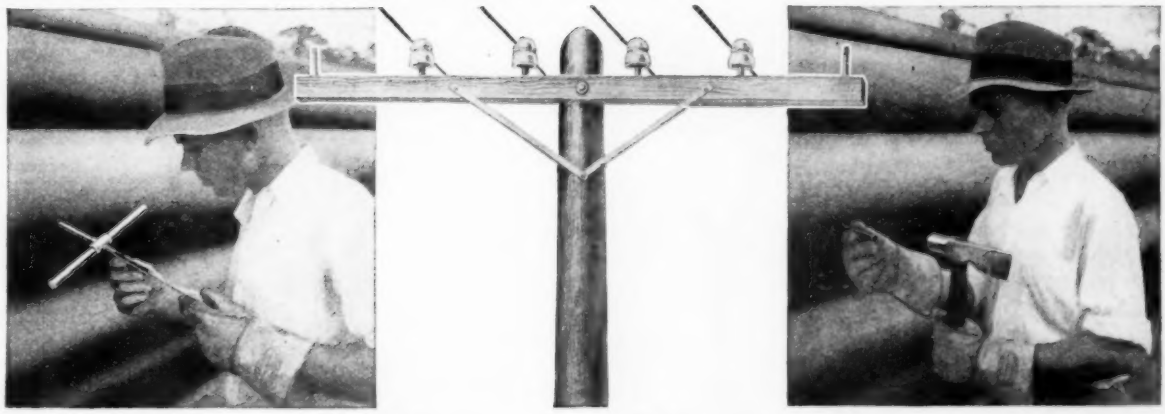
ONE REED!

ONE CONTACT!

IDEAL WAVE FORM

MONEY BACK GUARANTEE

Converts 60 Cycle Lighting Current to 20 Cycle Ringing Current
NO RADIO INTERFERENCE
Very low current consumption
Try out our Heavy Duty Model
EX TELERING
equipped with Filter and be convinced.
Price $44.00—F.O.B. Elyria
IT PAYS FOR ITSELF
Sold by Leading Telephone Distributors
Manufactured by
The Colson Co., Elyria, Ohio
(Write for booklet)



THE MOST RIGID SPECIFICATIONS WE HAVE TO MEET ~ ARE OUR OWN

THE last operation, the final inspection ... comes after the poles leave the treating cylinders. Each pole is then bored to determine the exact depth of impregnation, convincing proof of its decay, insect, and fire resistant qualities. After the test is made, the hole is securely plugged with a creosoted dowel. Those poles which have successfully passed our own rigid specifications are stacked, awaiting service, confident that their performance will come up to the customary Long-Bell standards.

THE LONG-BELL LUMBER COMPANY
208 R. A. Long Bldg. *Established 1875* Kansas City, Mo.

Let this Trade-Mark be your guide to pole purchases, your assurance of long and satisfactory service.

Long-Bell
CREOSOTED
YELLOW PINE
POLES

Television in Color

(*Continued from page 20.*)

cial "I" tube amplifier to obtain currents as high as 200 milliamperes.

The receiving apparatus at present consists of one of the 16-inch television discs used in our earlier experimental work. Behind it are the three special lamps and a lens system which focusses the light into a small aperture in front of the disc. The observer looking into this aperture receives, through each hole of the disc as it passes by, light from the three lamps—each controlled by its appropriate signal from the sending end. When the intensities of the three images are properly adjusted he therefore sees an image in its true colors, and with the general appearance of a small colored motion picture.

Satisfactory television in colors is a far more difficult task than is monochromatic television. Errors of quality which would pass unnoticed in an image of only one color may be fatal to true color reproduction where three such images are superimposed and viewed simultaneously. In three-color television any deviations from correct tone rendering throw out the balance of the colors so that while the three images might be adjusted to give certain colors properly, others would suffer from excess or deficiency of certain of the constituents. A further source of erroneous color exists at the scanning end. If the light from the object were not distributed equally to all the cells, the object would appear as if illuminated by lights of different colors shining on it from different directions.

Color television constitutes a definite further step in the solution of the many problems presented in the electrical communication of images. It is, however, obviously more expensive as well as more difficult than the earlier monochromatic form, involving extra communication channels as well as additional apparatus.

New Telephone Unit at Fort Wayne, Indiana

An order for the initial equipment for a new 10,000 line, full Automatic unit, the estimated cost of which when installed complete, is approximately $600,000, has been placed with the Automatic Electric, Inc., of Chicago, by the Home Telephone & Telegraph company of Fort Wayne, Indiana.

The installation of a new unit which will correspond in size with the Anthony and Harrison units now in operation, is made necessary by the growth of Fort Wayne. The present equipment in both the Anthony and Harrison offices is taxed almost to capacity.

The initial equipment for the new unit is scheduled to be placed in service coincident with the issue of a new directory June 1, 1930. The entire new unit will be housed in the Anthony Office Building of the Home Telephone & Telegraph company at 303 East Berry street. Ample space for the addition exists as telephone officials anticipated the need when the building was built a few years ago.

A third automatic unit in Fort Wayne will occasion no change in the operation of the equipment. Subscribers when dialing a number served by the new unit simply will be required to dial the new unit prefix, probably "E." When dialing numbers served by the Anthony or Harrison units, subscribers will dial "A" or "H" as at present.

An additional order for 500 lines of equipment for the Harrison office of the company has also been placed. This order calls for completion on about January 1, 1930, and includes 300 residence lines, 100 business lines and 100 semi-public pay station lines. The estimated cost is $40,000.

Present equipment in the Harrison office of the telephone company also is taxed to capacity. The tremendous growth in the south end of the city, which is served by that office, makes necessary the installation of the additional equipment.

A. T. & T. Stocks Soar—Why?

Investors with money seem to think that the stock in American Telephone & Telegraph Company, affectionately known as "A. T. & T.," is good property. The value of the 12,900,000 shares outstanding increased the week of June 22-27 by $335,319,764.

A third of a billion in five days is not bad.

In an official statement issued the management of the American Telephone & Telegraph Co. states no developments are under way to account for the recent advance in the stock and no splitup in the issue, extra dividend or any immediate new financing is comtemplated.

Frank J. Baker Promoted

Promotion of Frank J. Baker, operating engineer for the Home Telephone & Telegraph company of Fort Wayne, Indiana, to the position of assistant general plant superintendent has been announced by Harry E. Gray, general plant superintendent and chief engineer.

Mr. Baker will continue in the duties of supervising maintenance and installation forces which he performed previously and in addition will assist the general plant superintendent in supervising the work of the entire plant department.

Mr. Baker has been in the employ of the telephone company here for the past nineteen years. He has acted in numerous capacities. In 1926 he was made operating engineer which position he has held until his present promotion.

Quebec Telephone & Power Corporation Making Extensions

Montreal.—Quebec Telephone & Power Corp. is spending considerable money on extensions and improvements this year. The company also is making progress on unifying the operations of three new subsidiaries acquired since the first of the year—the Peoples Megantic Telephone Co., St. Ephrem Telephone Co. and St. Joseph de Beauce Telephone Co. Company plans this year to build 21 miles of new line in Portneuf County.

New York Telephone Company to Lay 150 Miles of Cable

What is considered one of the largest construction jobs of the year is that planned by the New York Telephone company to lay 150 miles of underground cable between New York and Albany. The line is one of the biggest engineering projects in the east and will be but seventy-five miles shorter than the cross country telephone subway between Boston and New York.

The new underground conduit will be of glazed tile capable of providing for four toll cables. The field work is going forward coincident with construction of the company's new nine story annex in Albany.

While telephone company officials were reluctant to make known the cost of the project some idea of the investment required may be gleaned by an estimate of the cost of 150 miles of glazed tile, tons of copper cable, excavation operations and right of way.

While the telephone company last year erected a pole line on the west side of the river over virtually the same route to be used for the new underground circuit, plans for installation of new cables contemplated construction of a subway instead. Storms, sleet and high winds contribute to a high maintenance cost of the cable carried on poles. This cost can be obviated to considerable extent by placing the cable underground, it was said, although original construction cost is much greater.

Albany is one of the big toll centers of the state. It is the hub for all Montreal calls south as well as those from the west and the southern tier of New York State.

The Albany-New York underground cable will be in all respects one of the most ambitious engineering achievements of the company in this state. Construction may require more than a year but when the project is completed the company expects to have facilities available for all future demands for some years to come.

Several islands off the coast of Maine are being connected with the mainland by telephone cables this summer.

R. C. A. Extends Radio Cable to South America

New York.—Extension of communications service of Radio Corporations of American territory previously under concession to All American Cables, subsidiary of International Telephone and Telegraph Company, was announced recently by W. A. Winterbottom, vice-president in charge of communications of R. C. A. Communications, Inc.

An office will be opened in the business center of Bogota, Colombia, to provide a fast direct-radio telegraph service. This extension of service was made possible by a recent concession granted the Marconi Company by the Colombian government and the Radio company will install equipment to take the place of the land line by which messages were formerly relayed from the Marconi station, located outside of the city.

Though assuming the aspect of a competitive step, the new service to be offered by Radio would fit in with the International Telephone and Telegraph program in Colombia in the event the sale of R. C. A. Communications, Inc., to the former is allowed by the government. At present such alliances are forbidden under the White act, and the sale of the Radio Corporation communications branch was only tentatively agreed on about March 28, pending a possible modification of the act.

To Barranquilla, Buenaventura and Cartagena the ordinary rate is 40 cents a word; deferred rate is 20 cents and urgent 1.20. Radioletter and week-end radioletter services are also available at 13½ and 10 cents a word, respectively, with a minimum charge for twenty words.

The corresponding rates to Bogota, Alcala, Arjona, Calarca, Cali, Carmen-Bolivar, Cartago-Valle, Cisnerosvalle, Corozal, Dagua, Facatativa, Gamarra, Girardot, Ibague, La Gloria, La Mesa, Madrid, Megangue, Mompos, Montenegro, Ocana-Norte-de-Santander, Ovejas, Palmira-Valle, Quimbaya, Real del Obispo, Since, Socorro, Tamalameque, Tulua, Turbaco and Zarzal are: ordinary, 42 cents; deferred, 22 cents; urgent, $1.26; radioletters, 15½ cents; week-end radioletters, 12 cents.

To all other places in Colombia the rates are: 43 cents; deferred, 25 cents; urgents, $1.35; radioletters, 18½ cents; week-end radioletters, 15 cents.

A. T. & T. Net for Six Months Is $80,202,096

New York.—The American Telephone and Telegraph company earned $6.15 a share on 13,028,807 average number of shares outstanding during the first half of 1929, as compared with $6.17 a share earned on 11,117,545 average number of shares in the first half of 1928, with net income amounting to $80,202,096 after charges and federal taxes, against $68,671,769 earned in the first half of 1928, a gain of $11,530,327, or 16.8 per cent.

Net income for the second quarter of 1929 amounted to $39,555,017 after charges, equal to $3.03 a share on 13,028,807 shares, comparing with $40,647,079 or $3.15 a share on 12,909,980 average number of shares outstanding during the preceding quarter, and with $35,076,976, or $3.15 a share earned in the June quarter of 1928.

American Telephone & Telegraph

American Telephone & Telegraph will spend billions of dollars over the next 10 years or more for new construction, and this means a substantial increase in the company's capitalization. The increase in capitalization in turn means that shareholders are to receive valuable rights from time to time. But rest assured that American Telephone & Telegraph's earnings will grow proportionately with construction expenditures, and as long as a company like American Telephone & Telegraph grows you can depend upon it that the country is not going backwards.—Wall Street Journal.

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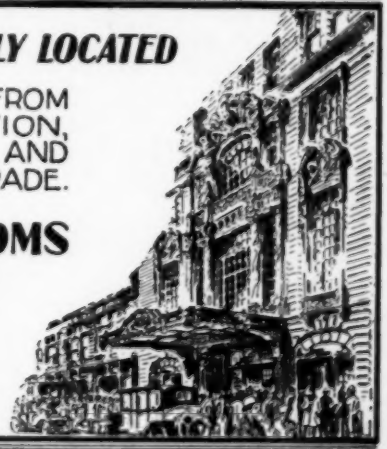

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CHICAGO

Associated Telephone Utilities Company Acquires Large Holdings in Several States

Through the consolidation of a number of telephone companies, the Associated Telephone Utilities Co. has grown very swiftly in the last few months. Acquisition of holding companies and their subsidiaries, scattered through Illincis, Indiana, Iowa, Texas, Oklahoma, Washington, Idaho, Montana and other states, it is claimed, makes this group one of the largest independent telephone organizations in the country.

The subsidiary companies serve a population of 2,612,000 and operate 304,453 stations in 1,032 communities. A total of 10,162 miles of toll pole lines are operated and service by the entire group is rendered in fifteen states. Total annual gross earnings are estimated at about $10,000,000.

One of the largest recent acquisitions was the Standard Telephone Co. and its three subsidiaries, Standard Telephone Co. of Illinois, Standard Telephone Co. of Texas, and Interstate Utilities Co. This group operates approximately 45,000 stations serving 600,000 people and its gross earnings in 1928 were $1,440,000.

The Central Telephone Co. and its subsidiaries, operating in the central west, acquired in July, made another strong link in the chain. Farmers Telephone & Telegraph Co., operating 5,300 stations in Wenatchee, Cashmere and Leavenworth, Wash. is another taken over according to announcement issued on July 31.

Purchase of the Indiana Telephone Securities Corp. with subsidiaries operating in Logansport, Greencastle and surrounding territory in Indiana, was announced early in August. These expansions have resulted in an active demand for the stocks and securities of the Associated Telephone Utilities Company.

As a result of these acquisitions, the Associated serves 812,000 more population than it did a few months ago while its increase in number of stations is 98,534 or 48 per cent. Through the same efforts, its mileage of toll pole lines was increased 72 per cent and its annual gross earnings, increased 43 per cent.

Men high up in the telephone industry foresee in the events the beginning of an era of strengthening and consolidation which may reach out eventually to hundreds of units.

Fort Wayne Veteran Promoted

Promotion of Frank X. S'aub, veteran employe of the Home Telephone & Telegraph company, of Fort Wayne, Indiana, to a newly created position of commercial engineer, has been announced by Otto Marahrens, secretary and general manager of the company.

In making the announcement Mr. Marahrens stated that the creation of the position which Mr. Staub will fill was made necessary by the increasing telephone needs of Fort Wayne's businesses and industries. He will advise with architects and builders, when requested, so that suitable arrangements for necessary telephone facilities will be a part of building plans. Mr. Staub will continue to have charge of all company buildings.

Mr. Staub has been in the employ of the telephone company here for the last thirty-four years. His services began at a time when the company started the building of pole lines preparatory to serving Fort Wayne telephone users. Since then Mr. Staub has acted in various capacities for the company. In 1924 he was made building and equipment engineer, which position he has held until his present promotion.

Mr. Staub is President of The Home Telephone athletic association. He is in charge of all safety work at the telephone plant and is also president of the Fort Wayne Safety Council. He is a member of the Telephone Pioneers of America and of the Independent Telephone Pioneers.

Friendly Receivership for Federal Telephone

Lester E. Noble, president of the Federal Telephone Manufacturing corporation, and Samuel Botsford, manager of the Buffalo Chamber of Commerce, have been appointed equity receivers of the business and assets of the Federal Telephone Manufacturing corporation. The appointments are the result of a friendly conservation suit and were made in the United States District court for the western district of New York by Judge John R. Hazel of Buffalo.

The complaint made by the Acme Apparatus corporation of Cambridge, Mass., alleges that although Federal Telephone is solvent, with assets considerably larger than its liabilities, it is unable to meet its current obligations in the ordinary course of business. The Acme people, with a claim of $26,917, acted in behalf of all the creditors of Federal Telephone to conserve the latter's assets and good will in order to continue its business, the complaint states.

The Federal Telephone Manufacturing corporation, incorporated in 1924, makes radio receivers widely sold throughout the country by the Federal Radio corporation of Buffalo. The latter company is not involved in the receivership.

Acquires Federal Telephone

New York.—The Acoustic Products company has acquired the Federal Telephone Manufacturing Company of Buffalo; Eugene P. Herrman, president of the former company, announced. The purchase includes ownership of the Federal Radio Corporation and Federal Orthosonic, Ltd., subsidiary companies of Federal Telephone Manufacturing.

Holstein Telephone Firm Incorporated for $10,000

Sioux City, Ia.—Articles of incorporation were filed here Thursday in the office of Miss Katherine Stewart, county recorder, for the Holstein Telephone company, capitalized at $10,000. Officers of the company are Peter Arp, president; J. T. Walker, vice president; W. F. Hutton, secretary, and C. J. Wohlenberg, treasurer.

Manufacturers and Jobbers

Kellogg Completes New Universal Switchboard Bulletin

Demands for better and faster telephone service are increasing every day. The automobile and good roads have brought the smaller towns closer to the large cities where common battery service is available. The day of the "one horse town" is past and the people are justified in expecting superior telephone service.

This situation has become a serious problem to all telephone companies. They must be able to give this kind of service to those who demand it and must be able to get the rates necessary to give it.

An effective answer to this problem is given in the bulletin recently completed by the Kellogg Switchboard & Supply Company on the Kellogg Universal Switchboard.

The Kellogg Company has spent considerable time in studying and compiling statistics on the question. The many efficient improvements incorporated in the Universal Board assure the high grade of service that people are beginning to appreciate, and are beginning to find a necessity in their homes and business houses. It has been found by actual experience that subscribers are willing to pay the increased rates necessary for a modern telephone system. In many cities a majority of subscribers have joined in petitioning the commission for

rates assuring the new service.

Another interesting feature of the Kellogg Universal Switchboard explained in the new bulletin is that with a small initial investment the Universal settles the question of finance by spreading out the cost to meet any need, and helping to salvage the old magneto telephones.

The mechanism of the Universal Board, method of construction and Kellogg equipment are illustrated by a complete set of photographs and diagrams attractively arranged in the new bulletin.

The Kellogg Company will furnish this instructive manual upon request to anyone interested.

Kellogg Develops New Desk Stand and Receiver Cord

Within the past year Kellogg has developed and placed on the market a new type of cord designed to replace the ordinary cords now used on desk stands and receivers. The outstanding feature of this new cord is the development of a new kind of insulation that is more complete protection for the tinsel than any kind of insulation now in use.

The principal advantages in this new construction lie in the complete moisture proofing quality of the insulation and in lower manufacturing costs made possible by the elimination of costly materials and machine operations. In the new construction a layer of rubberized composition replaces the former impregnated silk and cotton wrappings. This composition has all the qualities of pure rubber without any of the deficiencies. The new compound makes it possible to get away from all trouble due to hardening and cracking of the rubber. The new compound also gives the tinsel an absolute seal against water and prevents oxidization.

Long tests in the Kellogg laboratories and on telephones used under the most strenuous conditions show that there is positively no deterioration due to oxidization of the tinsel or to hardening and cracking of the insulating compound.

Experimental cords have been in use from one to three years in many exchanges. Tests of these cords show them to be as efficient as when first placed in use. The extremely tough outer braid used in wrapping Kellogg cords has shown practically no wear in all these tests.

Of particular interest to telephone companies is the fact that these superior Kellogg cords can be made to sell at lower prices than quality cords have cost heretofore.

Eastman Donates Stromberg-Carlsons to Rochester Schools

George Eastman, camera king and noted philanthropist, celebrated his seventy-fifth birthday on July 12th by announcing a gift of Stromberg-Carlson radio receivers to three dozen of the public, parochial, and high schools of Rochester and its suburbs. This gift is part of an extensive plan being inaugurated in Rochester to bring the music of its famous Civic Orchestra to the school children of the city.

"Eight concerts a year will be given at each of the four (high) schools selected as centers," it was revealed by Arthur M. See, manager of the orchestra. "These concerts will be given on Tuesday afternoons. The time will be decided later, depending largely on arrangements of public school officials. These four schools will form a circuit for the afternoon concerts and the orchestra will make eight trips around the circuit. These concerts are free to the children in the centers who can both see and hear the orchestra and naturally to those who listen to them by radio. These same four centers will be the scene of 32 Sunday afternoon concerts, designed to interest all the residents of the community. At least a part of these concerts will be broadcast."

New Battery Compound for Storage Batteries

A new battery compound has just been announced by the Goodyear Chemical Co., Inc., of 20 West 22nd street, New York City, manufacturers of commercial chemicals. The new product, "Electex," it is claimed increases the efficiency of all storage batteries using sulphuric acid electrolyte, according to L. E. Burkhart, the inventor.

Burkhart, president of the Goodyear Chemical Company, states that Electex is the first battery compound which has met the "exacting specifications necessary to obtain a satisfactory report of the Electrical Testing Laboratories, of New York City."

Describing the new compound, and the favorable report of the Electrical Testing Laboratories, Burkhart says:

"Electex is a non-acid compound,

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Western Elec. No. 329 Transmitters with back & mouthpiece @	1.25
Western Elec. No. 250 or 229 Transmitters with back and mouthpieces @	1.15
Western Elec. No. 143 Receivers with cords @	1.25
Gray 3-slot wall or desk type paystations @	5.75
Gray 5c single slot desk or wall type paystations @	1.25
Kellogg No. 30A combine line drops and jacks, per strip of 10 @	12.50
Stromberg No. 986 C. B. desk set complete with No. 1132 Steel bell box with straight line or 16-33-50 or 16 cycle ringers @	6.75
Kellogg No. 34 2-M. F. Condensers @	.40
Western Elec. No. 20 desk set with W. E. Trans. & Rec. and new cabinet inside connection signal set 3-bar 1000 or 1600 ohm $10.00—4-bar $10.75—5-bar @	11.75
Kellogg No. 22 L. C. Transmitters with back and mouthpieces @	1.10

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"All so-called battery compounds heretofore offered to the public have been acid solutions greatly injurious to batteries. Such preparations have in most cases been publicly discredited through the activities of the Better Business Bureaus.

"In the exhaustive tests conducted by the Electrical Testing Laboratories, Electex was found to increase the efficiency of the ordinary storage battery used in automobiles 133 per cent. Of the batteries used in the experiment one was a discarded radio type, the highest efficiency reading was 5 per cent. When Electex was added the efficiency increased to 9½ per cent—an increase of 95 per cent.

Mr. Burkhart states that Electex is now being sold in Europe in large quantities, and that his organization is now prepared to manufacture the product in large quantities for the American market. Electex has been tested with "unvaryingly successful results," he says, by radio stations, railroads, various transportation companies and operators of large bus companies.

Chas. M. Kerr Heads New Orleans Branch of the A. S. C. E.

Chas. M. Kerr, Field Engineer, Service Bureau, American Wood-Preservers' Association, was elected president of the New Orleans section of the American Society of Civil Engineers at the organization's annual meeting in May.

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Same with F-404-HA harmonic bell boxes	8.50
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Kellogg F-75-HA or F-404-HA bell boxes only	3.50

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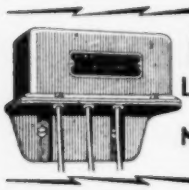
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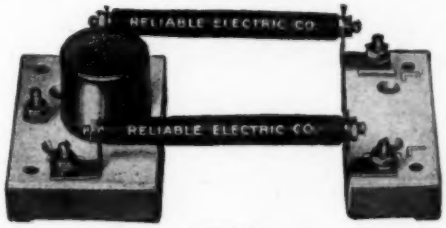

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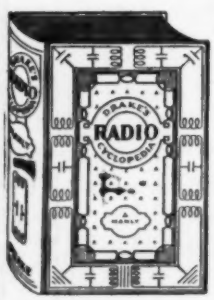

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